CESI NEWS

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

FILE SHEETS

1-25

· activities for the classroom ·

CESI NEWS FILE SHEETS 1-25
-activities for the classroom-

originals by Members of CESI
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Philip Parfitt, Gil Twiest, and Barry VanDeman produced this reprint of File Sheets in book form. Philip Parfitt reworked the early File Sheets which required editing and paste-up prior to publication.

Many people are responsible for contributing ideas, writing, typing, and preparing File Sheets. To all who have contributed, we are truly grateful.

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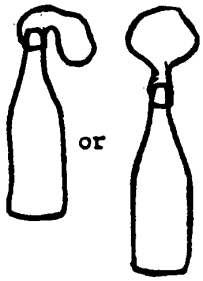
CESI FILE SHEET #1

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

A Neat Winter Activity

The children cap them.



They warm them up.

Back in the cold again.

Plan to do this lesson on a cold day when the outside temperature is near freezing or when there are sizable snow banks on the school grounds.

About an hour before the lesson, "plant" one pop bottle for each 2 or 3 children in your class. If there are snowbanks, push the bottles into the snow so that the open end sticks out of the snow. If there is no snow, place the bottles in inconspicuous shady places such as under shrubbery or ledges.

Suggested Procedure

I. Give each team of 2 or 3 children a balloon. Put several spare balloons in your pocket in case any balloons leak or get broken.

Take the class outside and explain that each team is to find a bottle and immediately cap it with a balloon. When they have done this, leisurely walk the children back to the classrrom.

The children will soon be commenting on the changes they observe as the balloons slowly enlarge. Usually the children start trying to make their balloons get bigger, using a variety of methods. During this phase of the activity, move from group to group, encouraging discussion, checking for safety, helping children as needed. Seek ways to help the children express in their own words ideas such as:

a. Air has neither been added to or taken away from the closed system.

b. As air gets warmer it takes up more space (unless enclosed in a rigid system.)

II. When creative ideas for making the balloons get bigger seem to be waning, have the children remove their balloons (letting some of the air escape from the system.) Then instruct them to put the limp balloons back on their bottle. Take the class outdoors to return the bottles to where they found them.

The results are usually impressive and stimulate good discussion.

We recommend that this activity be used after children have a concept that the space in the bottles and balloons contains air. The results in this activity are better if the balloons have been stretched before-hand. The best way is to blow up each balloon once or twice.

Some methods that children have used to warm their bottles:

* holding bottles in their warm hands
* tucking the bottles under their armpits.
* holding the bottles on or near a warm radiator
* holding bottles under warm running water
* placing bottles in a container of hot water

Be alert for safety. Only heat proof glass should be heated with a flame or on a stove—with a wire protector!

RELATED ACTIVITIES

a. Dip the opening of a jar in a soap bubble solution. Alternately warm and cool the jar and observe changes in the shape of the bubble. [Note: bubble often breaks and must be replaced but it is interesting and fun when it works!]

b. Use and "empty" plastic bottle which can be sealed with a lid or stopper. Make a pinhole in the side of the bottle.
Place it under ice water or cold water. Water will move into the bottle through the hole.

Textbooks and activity books have a variety of other activities on expansion and contraction of air when heated or cooled.

As one extension of this activity with fifth graders and above, questions such as the following might be raised and investigated.
1. What effect does using different size, shape, and/or thickness of balloons have?
2. What would happen if we used different sized bottles?

SOME LEARNING OUTCOMES
Learning outcomes expressed in child language—ordered in levels of sophistication.

* air takes up more space when we heat it
* air swells up when it gets warmer
* the air gets smaller when it gets cold
* cooling air makes it shrink
* we don't add or take away air, it just changes its size
* as air gets bigger it pushes in the balloon and stretches it

* when we heat the air it pushes harder on the balloon than the air in the room
* when the air gets cold it doesn't push as hard on the balloon as the air on the outside of the balloon
* air expands when we heat it
* air contracts when it gets colder

* when air is confined in a rigid container it can't expand but it exerts more pressure it it is heated
* when air is confined in a rigid container it fills the space but when it is cooled, it has less pressure than before
* when the balloon is changing size the push [pressure] is unbalanced. When the balloon is not changing size the push [pressure] is the same inside as outside. It's in equilibrium.

CESI FILE SHEET # 2

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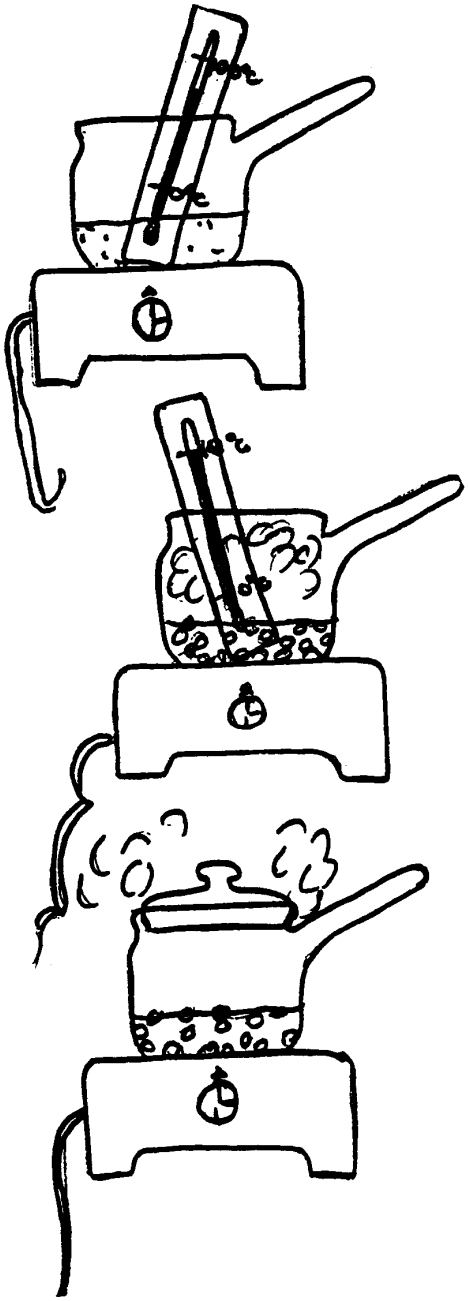


A Watched Pot

Place a pot with about an inch of cold water on a stove or hot plate. Do not put on a lid. Turn on the heat to a medium setting (or high if the stove you are using is slow to heat). Instruct the children to observe and report all observations. Continue until the water is boiling vigorously.

We predict that your children will notice some things you never noticed before, including:

* small bubbles appear early, before, the water is very warm, on the bottom and sides of the pot
* some of these bubbles occasionally float to the surface and disappear
* a swirling effect may be observed in the water
* larger, more vigorous bubbles form at the bottom, many rise to the top rapidly and usually can be seen to release a visible puff of water vapor
* a cloud effect develops above the surface of the water.

This investigation is enhanced if a glass container is used (pyrex saucepan, coffee pot or tea kettle or glass beaker or flask).

If a lid is later placed on the glass container, some differences will be observed.

During discussion use questions such as:

What do you observe?
What change do you notice?
How would you describe the bubbles?
How are these bubbles different from the first?
What do you notice above the water?

SAFETY CONSIDERATIONS

Take precautions to be sure that electrical cords are safely arranged to avoid tripping or possible upset of stove or pot.

Have potholders or other gadgets handy for handling the container of hot water.
Be sure children do not crowd too close when observing.

If a glass container is used be sure it is made of glass that can safely be used on a stove top. Most manufacturers recommend that a wire triangle or screen be used between the stove surface and the glass pot, especially if the high stove setting is used.

Do not use a tight fitting lid (such as a stopper in a flask) when heating a container.

SOME CONCEPTS WHICH CAN BE DEVELOPED

The first "lazy" bubbles are air coming out of solution. It is interesting to evolve the idea that gases are less soluble in water as the temperature of the water increases. This is the opposite of the more familiar generalization that sugar, salt, tea, etc. are more soluble as the temperature of water increases.

The bubbles associated with boiling are larger and more energetic than the air bubbles seen while the water is warming up. These bubbles are mainly made up of steam—(water changed by heat to invisible gas.) A small amount of water changes into a larger volume of steam.

As water is heated, its temperature increases until it reaches its boiling temperature—about 100 degrees C or 212 degrees F—depending on how pure the water is and upon the atmospheric pressure. Once this temperature is reached, the temperature remains the same no matter how vigorously or how long the water boils.

Adding salt, sugar, or many other substances to water, raises the boiling point to a new constant boiling temperature. The concentration of this new solution determines the amount of increase. What change would you predict in the boiling point as salt water boils vigorously giving off steam?

The "Swirling" effect sometimes observed as water heats up results from convection currents. As water at the bottom gets warmer, it expands and therefore becomes lighter than the colder water above it. The heavier colder water tends to fall to the bottom, lighter warm or hot water tends to move upward.

Warm air can hold more invisible water vapor than cool or cold air. Fog or clouds may disappear (the water vapor becomes invisible) when the air containing them becomes warmer. Fog or clouds may appear (invisible moisture condenses to form larger visible droplets) as air is cooled.

Drops of water tend to condense out of humid air when the air comes in contact with cooler surfaces.

RELATED ACTIVITIES

Textbook and activity references offer a good variety of activities related to boiling and to moisture in the air. We offer the following as examples.

1. Place a thermometer in the container of water. Observe and record the temperature at regular intervals.

2. Repeat the above activity adding about a tablespoon of salt. Use a thermometer to compare the temperature of boiling salt water with boiling tap water. Try other substances such as sugar, sand, baking soda, tea, coffee, etc.

3. Fill a glass or jar with cold tap water. Let it stand in the warm room. Air bubbles will be seen on the inner surface of the container as some of the air that was dissolved in the water comes out of solution as the water temperature increases. Some moisture may also appear on the outside of the glass. Invisible water vapor in the air near the cold glass condenses on the glass. It is also interesting to set up a like container of warm water next to the one with cold water. This allows for comparison and a basis for cause and effect discussion.

4. Make a graph to show the temperature pattern from starting temperature through about 5 minutes of boiling. Record the temperature readings at 1 minute intervals or 30 second intervals.

5. Use a pyrex flask. You will need a stopper with which you can seal the opening. Use one which sticks out at least 6 mm. (44in.) above flask top when in place.

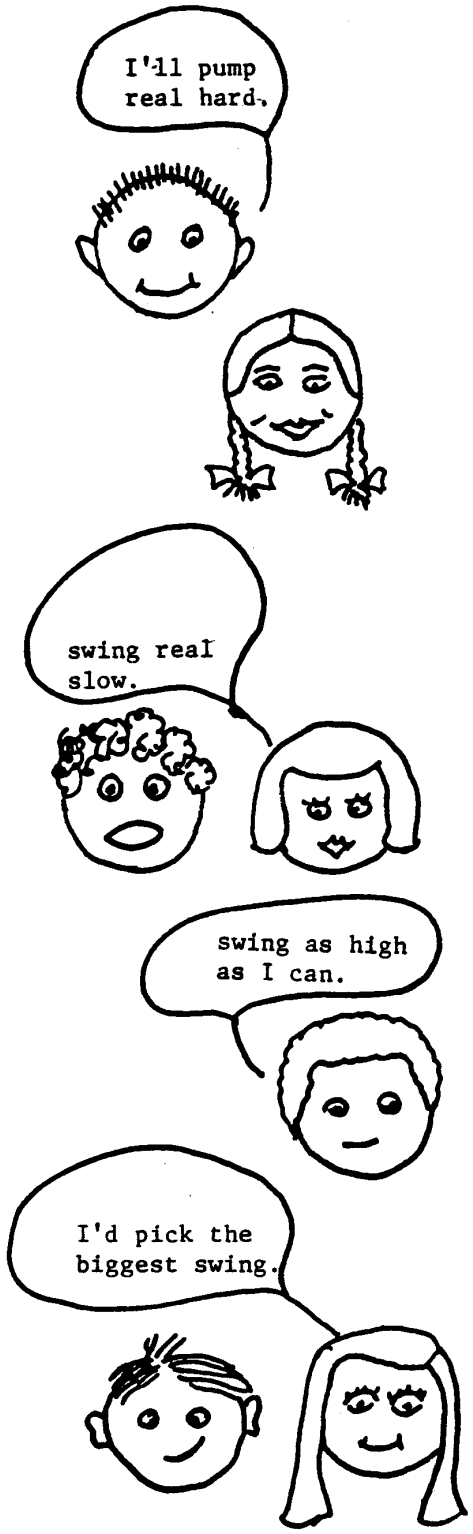
Place an inch or two of water in the flask. Do not insert stopper. Bring the water to a boil. Remove the flask from the heat (use potholder or tongs) and insert the stopper. Cool the flask by placing or wrapping it in a cloth soaked in cold water. If the water dosen't start to bubble within a minute dip the cloth in cold water again and wrap it around the flask.

The water will boil again! Cooling causes steam in space above the water to condense, lowering the pressure in the flask.. Lowering the pressure lowers the boiling point.

The cooling process can be repeated several times; never remove the stopper. It is usually possible to get water to boil when its temperature gets low enough to comfortably handle the flask with bare hands! Note—The stopper may be difficult to remove when the activity is finished because of the difference between the room air pressure and the low pressure in the flask.

CESI FILE SHEET # 3

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE



Science on the Playground

Does your school have a playground or nearby park with swings and/or seesaws?

GREAT!

Swings provide a laboratory for studying pendulums!
Seesaws provide a laboratory for studying levers!

This file sheet presents some ways for you to teach some science using playground swings as pendulums.

PRIMARY GRADES

Launch this investigation in any way your ingenuity suggests.

One idea—Have the children pretend that there is a rule that each child is allowed a turn at the swings during which he/she can have just 100 swings.

Raise the question: What could you do to have the longest time for you turn?

These children are talking about variables! Choose one variable at a time for them to investigate.

For example—Investigate whether swinging "real high" 100 times takes longer than swinging 100 times in just a little arc.

CONTROLING VARIABLES To make this a fair test, you will need to use the same child and the same swing for both trials.

GATHERING SUFFICIENT DATA TO JUSTIFY A CONCLUSION To check the first set of results, this same experiment will need to be repeated by several other children.

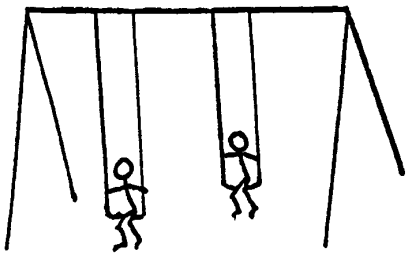
MEASUREMENT Use a stop watch or a watch with a second hand to determine how long 100 swings will take.

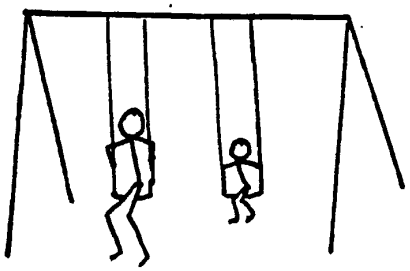
OTHER DIFFERENCES TO INVESTIGATE

Compare how long it takes for 100 swings on the shortest length swing with 100 swings on the longest length swing.

Find out what happens when the difference is weight of the swinger. If you use a child and the teacher the weight difference will be appreciable and the child sensitivity problems about weight will be avoided.

Experiment with any other differences the children suggest, within limits of safety.





INTERMEDIATE GRADES AND JUNIOR HIGH

Carry out the same investigations as described for primary grades. You might prefer to gather data in terms of number of swings per minute rather than times per 100 swings. Plan to build into this lesson some or all of the following:

1. recording data
2. repeating trials until data is sufficient to justify a conclusion
3. averaging
4. identifying and controling variables
5. drawing tentative conclusions
6. critical thinking

After the children have investigated the effects of changing variables for playground swings, continue the study of swinging things [pendulums] in the classroom.

- Film Can

Punch hole in lid. "Anchor" string with knot or button.

Suggestions

Use string, cord, fishline, etc. to suspend the swinging weight.

Some examples of things to use for weight.

- empty 35 mm film cans, add coins, pebbles, sand, to vary weight
- key rings with varying numbers of keys
- small cans with objects added to vary weight
- varying numbers of metal washers

Some ways to suspend the pendulums

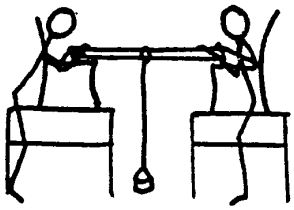
- coat closet hooks
- broomstick across two chairs or desks

BACKGROUND INFORMATION

The following terms associated with pendulums might be introduced at the intermediate level and above.

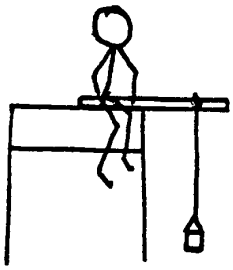
BOB The weight suspended as part of the pendulum

FREQUENCY The number of swings per unit of time.



In a well constructed pendulum, length is the only variable which affects the frequency. "Sneaky variables" in the pendulums the children work with in the classroom may produce data that contradicts this.

1. as weight is increased, the swing may stretch, changing the length
2. when weight is changed, the center of gravity of the bob may change, thus changing the effective length of the pendulum
3. the knot where the pendulum is attached to the support may shift during swinging, resulting in conflicting data



The effective length of a pendulum is the distance from the point of suspension to the center of gravity of the bob. This may help explain some of the children's experimental results which do not agree with theoretical results.

A pendulum exactly one metre long has a frequency of 60 swings per minute. This can be related to the length of the pendulums of grandfather clocks.

ADDITIONAL ACTIVITIES

1. Encourage children to make observations of pendulum clocks, noting approximate lengths of the pendulums and counting the number of swings per minute. Compare observations and guide children to relate these observations to the results of the investigations they did in class.

Usually this leads to questions about how the pendulum functions in a clock. Perhaps someone who makes, sells, or repairs clocks could be interviewed by a group of children—or—such a person might accept an invitation to come to the classroom and demonstrate and explain how pendulum clocks work.

2. Usually, during pendulum study, at least one child mentions a long pendulum seen at a museum. This is a Foucault Pendulum. It provides evidence of the rotation of the earth.

This can lead into a special project. Children can do some library research on the Foucault Pendulum. You or the children might find a description of a simple demonstration activity which shows pendulum action on a rotating object. This study of the Foucault Pendulum is recommended only for intermediate level classes and above.

3. A metronome is essentially an inverted pendulum. Children can compare the way a metronome works, and is adjusted, to the pendulums they have investigated. Some children might invent their own homemade metronomes.

CESI FILE SHEET #4

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Kids and Soap Bubbles

A lively combination for science lessons at any level!

The materials are inexpensive and readily available—commercial bubble solutions, liquid soap powders, cake soap, water, glycerine (drugstore), bubble pipes and loops, wire, pipe cleaners, and anything else children can find in their surroundings to try out as bubble makers.

Children can raise the kinds of questions they can answer by investigation.

scissors

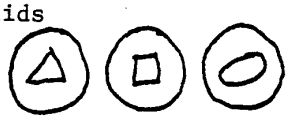
can with open ends

piece of screen

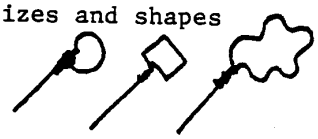
straws

pieces of tubing

cut holes in plastic lids



wire loops of different sizes and shapes



holes in keys, etc.

PROCESS

With some advance planning and good teacher guidance, while children are investigating soap bubbles there is good opportunity for growth in investigative processes:

- **observation skills**
- **cause and effect thinking**
- **infering—(including discriminating between observation and inferences)**
- **raising questions**
- **identifying and controlling variables**
- **curiosity and creative thinking**

CONTENT

Soap bubble investigations contribute background experiences to help in eventual understandings related to:

- **surface tension**
- **specific gravity**
- **convection currents**
- **properties of gases**
- **some geometric concepts, aspects of color and light**

SUGGESTIONS

You can well imagine that soap bubble activities are "drippy" and "messy." Floors sometimes get slippery, and cleanup is usually "sudsy."

Plan your investigations of soap bubbles for outdoors.

Use trays for equipment for each small group of children to minimize spillage and dripping on desks, floors, sidewalks, or ground.

If working indoors, cover desks or tables with newspapers to make cleanup easier.

CAUTION If working indoors, be alert for soap solution spills and drips which make the floor slippery. You might place several layers of newspapers over slippery spots to help make them safe.

SUGGESTED ACTIVITIES

PRIMARY LEVEL

1. Does blowing or waving bubble wand slowly or quickly produce the biggest bubbles?
2. If we use different shaped bubble makers can we get different shaped bubbles?
3. Can we discover anything by observation that will help us predict when a soap bubble is about to break?
4. Does the kind of surface a bubble lands on make a difference when it breaks?
5. Who can make the biggest bubble?
6. What kinds of things result in big bubbles, and what things seem to cause bubbles to be small?
7. Does the size of the bubble loop affect the size of the bubble?
8. What differences do we observe between bubbles made by blowing into the loop and bubbles made by waving the loop?

INTERMEDIATE LEVEL

All of the primary level activities plus
1. Are some brands of liquid soap solution better than others [size of bubbles, how long they last?]
2. How does the amount of dilution change the bubble making quality of the liquid soap?
3. What is the best recipe we can develop for our soap solution?
4. If the soap solution is heated or cooled does this change the bubbles we make?
5. What difference does the material we use for the loop make? [kind or thickness of wire, pipe cleaners, rubber, wood, plastic, etc.]
6. Try comparing the behavior of bubbles filled with room air and bubbles filled with exhaled air, bubbles filled with carbon dioxide gas. If you can obtain helium gas, try this too.

SOAP BUBBLE RECIPES

1. 1 part soap
   40 parts water
   13 parts glycerine

2. 1 quart water
   8 capfuls liquid detergent
   2 tsp. sugar

3. per pint dilute soap solution
   1 gram sugar
   5 cc glycerin

OPERATIONAL QUESTIONS—Basic Tool for Investigative Science

Look over the lists of questions suggested for investigation. We have coined a phrase for such questions, OPERATIONAL QUESTIONS. Operational questions are those which are worded in a way that suggest what one can do to try to find an answer. The answers children get are things they can KNOW. When children collect evidence by doing things, carefully, with their materials, they can be sure of their answers to such questions.

Contrast operational questions to the kind of questions children tend to ask in science—and, too often, teachers and textbooks ask.

> Why are soap bubbles round?
> Why does sugar in the solution make the bubbles better?
> What makes the colors in soap bubbles?

Our phrase for this type of question in NON-OPERATIONAL QUESTIONS. They are the kind of questions children rarely can answer with any certainty. They can only construct inferences or theories which tend to be vague and "wild!" Sometimes after they have found relevant operational questions they can figure out answers to some non-operational questions based on the evidence they have gathered.

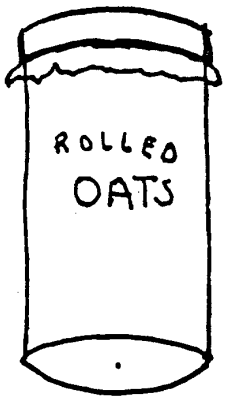
Other ways to seek answers to non-operational questions might be to "look it up" or consult an authority. But the answers to questions children ask often can't be found in books written at their level. If they do get answers to their "why" questions from books or "authority persons" often they cannot understand what they read or hear.

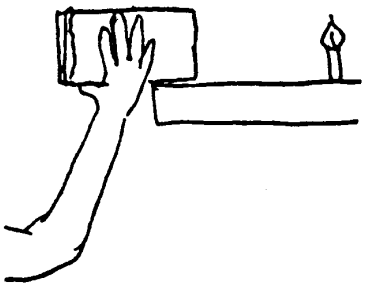
Let the OPERATIONAL QUESTION idea help you to teach science to your children. Through such questions and the resulting activities, children can build a rich background of process skill development and content knowing to help them succeed in the future when they study many of the "whys" in science.

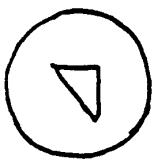
CESI FILE SHEET #5

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Pinhole Pictures







First, make your pinhole camera!

1. Start with an empty container such as an oatmeal box, salt box, or tin can (#1 size or larger.)

2. One end should be open, the other end closed. If a can is used, an automatic can opener helps assure a safe, smooth edge.

3. Poke a tiny hole in the center of the closed end. The smaller the hole the better your camera images will be. If the container is cardboard, use a pin or needle. If the container is metal, use a fine nail.

4. Cut a piece of waxed paper at least 2 inches in diameter larger than the size of the open end. Fasten it in place over the open end with a rubber band. The waxed paper must be smooth and taut across the opening.

Some things to do with your pinhole camera.

1. Partially darken the room. Light a candle and hold your "camera" between your eyes and the candle flame as in the drawing.

Adjust the distances until the image of the flame is clearly seen on the waxed paper screen.

Vary the distances between camera and candle and between eyes and camera. Note changes in image.

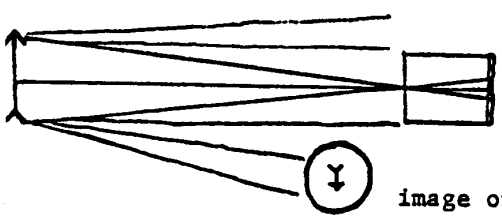
Change position of camera. How can you make the image move to the top, the bottom, the left side, the right side of the screen?

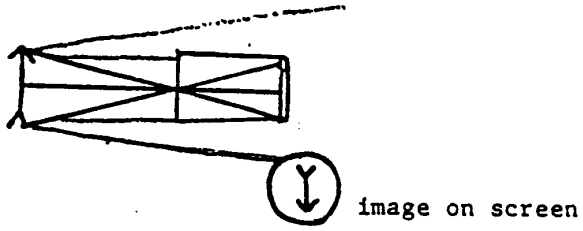
A flashlight is a safer and more satisfactory alternative for the candle.

Cut a disc of colored construction paper to fit over the lens of the flashlight. In the center of this disc cut out an asymetrical shape. Line this disc with a piece of waxed paper. Tape the disc over the lens of the flashlight.

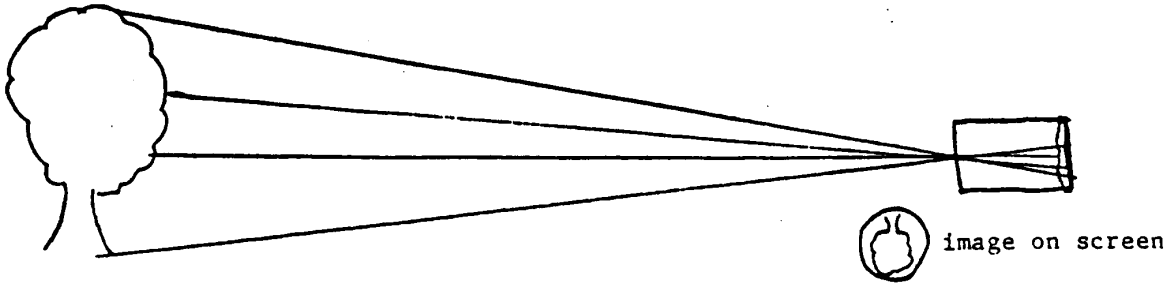
2. Partially darken the room. Stand near a window. Hold the pinhole camera a ways in front of your eyes with the screen turned toward you. Play around with the position of the "camera" and its distance from your eyes until you see an image of something outside (ie., a tree, house, car).

An infinite number of light beams are given off by the light source (candle or flashlight) in many directions.
The only beams that can get to the waxed paper screen are those which pass through the pinhole.
The heavy lines in the drawings above show some of the beams which get through the hole to reach the screen. The other lines represent some of the beams which cannot reach the screen.





The diagrams explain why the image is inverted and why the size of the image changes as the distance between the pinhole camera and the light source.



The images of outdoor objects can be explained as above

SUGGESTIONS FOR USING THE PINHOLE CAMERA

PRIMARY LEVEL The children will need help and guidance.

One or two pinhole cameras can be made up and placed in a learning center. The children can be shown how to use it and then encouraged to investigate during their free time. The flashlight idea should, of course, be used instead of the candle.
Enough cameras could be made so that each child or each small group of children can have one for a total class investigation lesson.
The children should be encouraged to:

1. observe to identify cause and effect relationships in their own words.
2. describe the image (picture) on the screen.

Try to see pictures of things outside using the pinhole camera.
Children can grow in vocabulary words and concepts such as bigger than, smaller than, image, pinhole, and opposite.

INTERMEDIATE LEVEL

These children can make their own pinhole cameras. With advance planning, the children can collect enough containers so that each child can make his own. All of the suggestions for primary are appropriate for intermediate level children.

IN ADDITION Children can identify conditions needed to obtain a good image. Children can raise operational questions and investigate to seek answers [i.e.: how small can the camera be and still work?]

ADDITIONAL ACTIVITIES

1. Compare a box camera with a pinhole camera.
2. An actual photo can be made if film is loaded on the back of the pinhole camera in a dark room and then the camera covered with a black cloth so that light does not spoil the film. A "time" exposure of 15-30 minutes will be needed and the camera cannot be "hand held" it should be firmly supported during exposure. The camera must then be adequately covered until the film is developed and printed. Only black and white film is suited for this crude photography.
3. Use a small magnifying lens instead of a pinhole [make the hole large enough for lens to admit and focus light].
4. Children should be encouraged to raise and investigate the kinds of questions they can find answers to by experimenting.
    a. Can a rectangular container, like a shoebox by used?
    b. How does the size of the pinhole affect the image?
    c. How large and how small a container can we use successfully?

Children can investigate the many cameras on the market to learn about some of the special kinds of things they enable photographers to do. Libraries, camera hobbyists, and photography shops are some resources they can use.

CESI FILE SHEET #6

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Ask the Snails

gallon jar aquarium

A snail aquarium rates high in simplicity and potential for studying science in the elementary classroom.

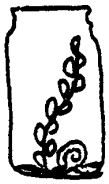
SNAILS from a pond or slow moving stream
from a friend's aquarium (snails usually reproduce so fast the owners are eager to give them away)
from a pet shop (they often sell several kinds)

CONTAINERS any clean, clear, glass, or plastic container of a quart or more capacity

WATER obtained from source of snails and/or tap water which has been allowed to stand in an open container for about 24 hours.

It is also desirable to include some plant material from a pond or aquarium, clean sand or gravel or, if snails were obtained in a pond, a thin layer of pond bottom material.

jelly jar aquarium
for individual study



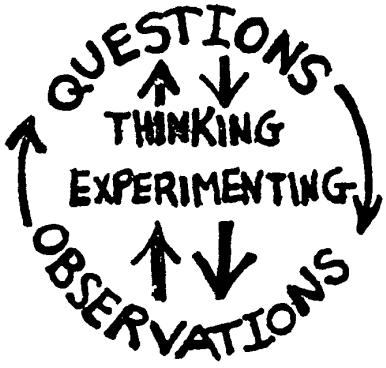
"Ask the _____" is one of the most useful phrases a teacher can use in science. Children are, by nature question askers. Many of their questions in science can be answered by observation or by simple experiments.

Be alert for opportunities in this snail study project to help children grow in their abiblity to observe, think, and try simple experiments to seek answers to their questions.

Watch, too, for opportunities in other science lessons to use the "Ask the _____" phrase i.e. "Ask the Magnets," "Ask the Seeds," "Ask the Snails."

SOME THINGS TO DO

Snails + Children
=

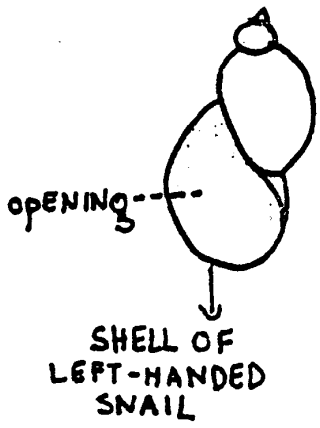


1. Encourage and welcome children's observations and questions.
2. Work out with them some way to keep records of both.
3. When conflicting observations are reported, encourage the children to reconcile them by further observations.
4. Provide one or more magnifying lenses by the snail aquarium.
5. Be alert for children's questions which might be answered by further observations or simple experimenting. Help and encourage the children to seek answers to these questions. When appropriate, foster a spirit of the tentative nature of inferences based on limited evidence. Encourage children to gather additional evidence to support or reject such inferences.
6. Watch for small gelatin-like egg clusters to appear on the glass or on plants. Encourage the children to study the development of the snails with the help of the hand lenses.
7. Provide, or help your children locate resource books which incude information and illustrations relevant to their snail study.

YOUR CHILDREN CAN

1. Place a snail on a glass or clear plastic surface and invert this to observe the wavelike action of the "foot" as it glides along. Use a hand lens, stereo microscope or microprojector.
2. Bring in additional kinds of snails from various sources.
3. Identify likenesses and differences within their collection of snails and snail shells.
4. Develop their own classification system for their collection.
5. Experiment to study snail reaction to environmental factors such as light, temperature, sealed versus unsealed environment, surfaces of different textures.
6. Observe the behavior of snails as it relates to respiration. Some snails can be observed rising to the surface to replenish their air supply and then moving downwards as the water gets warm, its dissolved air content decreases and snails tend to spend more time at or near the surface than they do when the water is cooler.

EXTENDING ACTIVITIES



1. Construct a food chain, based on observation and/or reference reading to include predators and prey for one or more of the snails studied.
2. Develop a snail collection. Label as many as possible, including interesting facts gleaned from observation and reading.
3. Produce a book about snails. Utilize the various interests and abilities of the children in the class in the distribution of tasks. Include such components as children's drawings, collected pictures, reports on observations and experiments and interesting information from reference books. Include also a section of questions raised by the children but not yet answered. The resulting book might be presented to the school or community library.

BACKGROUND INFORMATION

Snails usually serve as scavengers, eating decaying matter, algae, and other plant material. They have throny, rasping tongues which tear into plant tissue and scrape algae from surfaces. Bits of lettuce often make good snail food.

Aquatic snails may breath by gills or posses lung sacs. Gilled snails have a hard cover, called an OPERCULUM, which serves as protection when it seals the shell opening.

The eyes of snails are located at the end of the two longest feelers.

Snail shells may be right handed, left handed, or flat spirals. These patterns are helpful in classification and identification.

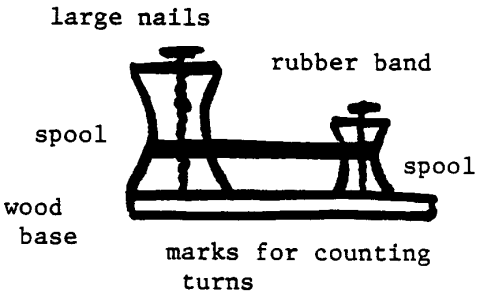
Snails produce mucous which leaves a conspicuous trail as they move across a surface. Sometimes they hang in the water by a mucous thread.

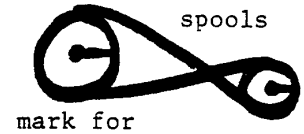
Snails can often be found in tidal pools. These can usually be kept for quite a while in a classroom. Strain some of the pool or pond water. Add tap water when needed to replace loss by evaporation. An aerator is desirable and may be essential.

CESI FILE SHEET # 7

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Investigating Wheels





criss-crossed rubber bands

arrangement with two rubber bands

"When I turn this spool, what does the other one do?"

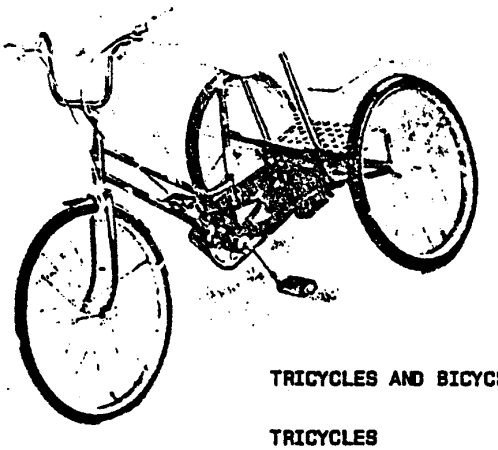
"Which turns faster, the big spool or the small spool?"

"Which feels easier to turn, the big spool or the small spool?"

Children can investigate the following:

- Two like size spools with uncrossed rubber band
- Two different size spools with uncrossed rubber band
- Two like size spools with crossed rubber band
- Two different spools with crossed rubber band
- Three spools with uncrossed rubber bands
- Three spools with crossed rubber bands
- Any other combination the children "invent"

After the children have worked with the various arrangements for a while, challenge them to predict the behavior of different spool combinations.



TRICYCLES AND BICYCLES

TRICYCLES

Have a child slowly ride the tricycle for appropriate parts of the discussion.

1. how do you make the tricycle move?
2. how does this make the wheels turn?
3. what things are the same about the wheels of the tricycle?
4. what differences can you find?
5. when the big wheel goes around once, how many times do the little wheels go around?
6. how do you make the tricycle go around a curve?
7. what is special about the little wheels that make this happen?
8. can we make the tricycle go backwards?
9. what can we do to make the tricycle stop?

BICYCLES

1. what does the rider do to make a bicycle go?
2. how does pushing on the pedals make the bicycle go?
3. when the pedals make one turn, how many turns does the front wheel make?
4. how many turns does the back wheel make?
5. what kinds of things do riders do when they are turning corners or going around curves?
6. how many ways can we safely use to stop the bicycle?

Turn each cycle upside down on the floor or a table.

1. Why don't the little wheels turn? Why do they turn when we are riding?
2. When we turn one little wheel, what does the other one do? How do you explain that?
3. When we push on the pedals, what do the wheels do?
4. How is the bicycle made to make this happen?
5. Which is easier to push, the pedal or the wheel? Try it and see how it feels.
6. Which goes around faster, the pedals, wheel or the bicycle wheel?
7. If the bicycle has several gears, have children analyze the changes that result when gears are shifted.

SOME WHEEL CONCEPTS

1. For some wheel arrangements we apply force to one wheel which causes other wheels to turn [i.e.: bicycle, egg beater, mill wheel].
2. Wheels can be designated to interact with each other through interesting arrangements such as: wheel to wheel contact, belts, chains, connecting rods, gears, etc.
3. Interacting wheels can be designed to transfer energy, change force, change speed, change direction, etc.
4. We can make wheels turn in many interesting and important ways [fuel, electricity, people power, wind water, etc.].
5. When a small wheel makes a big wheel turn, the big wheel:
   - turns more slowly than the small wheel
   - makes less than one turn for each turn of the small wheel
   - exerts a greater force than that applied to the small wheel
6. Vehicle wheels are attached in various interesting ways related to turning the vehicle around curves and corners.

GEARS-HAND POWERED EGGBEATER

Eggbeater

When we turn the handle of the eggbeater, several interesting things happen. Let's see how many you can figure out?

1. One wheel makes two wheels turn
2. We turn the big wheel on a vertical plane, the little wheels turn on a horizontal plane
3. The little wheels turn in opposite directions
4. The little wheels turn faster than the big wheel; several times for one turn of the big wheel
5. How many times do the little wheels turn for one turn of the big wheel?
6. Try pushing the handle. Next, try pushing a blade of a beater. Which feels easier?

NOTE Children may not be able to feel that it is easier to push the blade than it is to push the handle. Do not be concerned about this.

They often can feel the difference between using an eggbeater and using a spoon to mix moderately heavy dough or similar substance. We suggest using a fairly thick cookie dough or even a mud mixture to give them a chance to feel this difference.

An eggbeater is designed to give an advantage of speed. We sacrifice force for speed when we use an eggbeater.

Demonstrate with your right hand how the big wheel goes around while you show how a beater goes around with your left [fun activitiy and coordination challenge].

OTHER WHEEL AND GEAR INVESTIGATIONS

1. The turning rates of the two reels of a movie projector in the early and late parts of a film.
2. The way wheels are attached related to turning corners on baby strollers, grocery carts, roller skates, toys with wheels, etc.
3. Gear boards or other gear toys
4. School pencil sharpener with outer case removed
5. Wide track tractors and tanks

SUGGESTIONS FOR "PAYOFF" IN INVESTIGATIVE TYPE LESSONS

Use your professional judgment in selecting materials and concept goals for your children's maturity level.

GUIDE

Think of your role as that of GUIDE to LEARNING rather than as a SOURCE of LEARNING.

* The wheels are the "authority" for knowledge
* The WHEELS are the source of ideas
* Refer children back to the wheels when questions and/or disagreements develop

HANDS ON

Plan ahead so that all children can see and, when feasible, manipulate the wheels being studied.

* Children in large circle when studying bicycles and other large objects
* Enough small wheeled objects so that children can manipulate and observe them in groups of 3-5 children
* Use learning center to provide "hands on" investigation prior to class discussion and to provide for review and application

TIME

Allow time to observe, to think, to react, to communicate.

* After questions are raised, allow enough time (at least 3 seconds) for children to observe and to think
* Wait after each child's response for other children to react with agreement, disagreement, additional information, questions, etc.
* Wait after a child's quick or short answer for expansion or modification or response

UNDERSTANDING

Learning that makes sense to the learner

* Aim for responses that help children grow in understanding, when appropriate, use pursuing questions or comments that require children to support their statements with evidence, clarify or expand an idea by demonstrating with the wheels, express their ideas in their own words
* Minimize the use of "yes-no" questions
* Solicit expansion of response when child gives one word answers
* Be wary of "trite" or "regurgitated" responses. Probe further to find what the child means when he/she uses "stereotype" wording.
* Accept, with enthusiasm, any answer which a child can support with evidence or which reflects sincere thinking. Often we have one answer in mind when we ask a question but children who are observing and thinking come through with responses which are as good or better. It sure pays off to listen to children with as much interest and open mindedness as we hope they will bring to what we say.

CESI FILE SHEET # 8

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Recycling

As you watch raindrops splash against a window it can be interesting to speculate on the long history behind the water molecules in those drops. For example, a single molecule might have travelled the Nile, been exhaled by Napolean, been a tiny part of the ice age, ice, helped make up the wave that knocked you down at the beach last summer, etc.

A fallen woodland tree, left undistrubed, eventually changes into growth components in new trees and other plant materials.

That rusting tin can along the roadside will, if left there, decompose to release iron atoms, some of which eventually might be recycled into mineral components of roadside plants.

YOU TOO ARE A RECYCLED MARVEL! ESSENTIALLY EVERYTHING OF WHICH YOU ARE COMPOSED HAS, IN THE PAST, BEEN USED MANY TIMES IN MANY DIFFERENT WAYS.

Nature's recycling has been going on since the earth's beginning. Over and over, many of the elements of the earth's crust and atmosphere have undergone a variety of decompositions and rebuilding through physical and chemical changes. We are now just beginning to fully appreciate the wisdom and perhaps the necessity of recycling. Many of the waste materials of our "throw away" way of life are recognized as "something of value". Used aluminum is being retrieved and processed into usable aluminum. Kitchen wastes may someday provide some of the solutions to our energy problems. Gardening and farming practices sometimes utilize waste materials to help replace materials in the soil which are absorbed by growing plants. Other interesting examples of recycling are in use in experimental stages.

ACTIVITY A

Take your class to a woodsy area where fallen leaves have been accumulating over the years.

Have your children examine and describe the appearance of the accumulated materials on the woodland floor. The differences they can observe from the surface leaves, twigs, etc., down to the soil base shows the process of decompostion into humus over several years.

Have your children identify possible causes of breakdown of the plant materials (fungi, earthworms, "pillbugs," slugs, etc.)

Through discussion help your children grow in their understanding and "sense of wonder" for this example of recycling in nature. Many of the materials that were absorbed from the soil during a plant's growth are returned to the soil when it dies and thus available for reuse. Humus in soil also helps to absorb and hold moisture, so important for plant growth.

ACTIVITY B

Locate a rotting log in the woods. Examine this for evidence and causes of breakdown into humus. It may also be possible to compare logs in moist environments with those in dry locations.

ACTIVITY C

Locate a gardener who maintains a compost pile and arrange for a class visit to learn about composting. This is a way of using plant waste materials (and sometimes animal waste as well) to restore important soil components which were removed during plant growth.

For composting one utilizes plant materials such as lawn clippings, fallen leaves, garden waste materials, fruit and vegetable wastes from the kitchen. When practical, these are cut into small bits to help speed decompostion. Layers of such wastes are alternated with layers of soil (which helps provide decay organisms) and some garden fertilizer. The pile is "turned over" or mixed to assure adequate air needed by the organism to decay. It is also kept moist to aid in decompostion. The humus which is produced by composting is mixed in with garden soil to help restore minerals needed for plant growth and to help absorb and hold moisture in the soil.

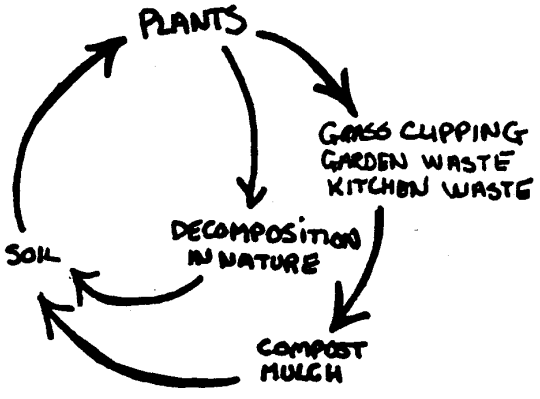
Some gardeners spread plant waste materials directly on the garden. They thus serve as mulch to cut down on the evaporation of water from the soil during the growing period. Later they can be worked into the soil to decompose into humus.

ACTIVITY D

An interesting variety of activites has been written which helps children appreciate the value of humus in soil. We suggest one. Others can be found in textbooks and other activity references.

Give each child or small group of children a pair of like containers, i.e. flower pots, milk cartons, etc.

Have the children use topsoil for potting in one of the containers and, in the other, sand or subsoil (soil from deep below the surface taken from the garden or recent excavation). Provide seeds or plants for the children to grow in their containers. Supervise the planting, watering, placement, and care of the plants. Differences in the growing plants should be observed over a period of several weeks.



A PLANT, MINERAL AND NUTRIENT CYCLE

ACTIVITY E

A school or class can develop and use its own compost.

Choose a location in an out-of-the-way place on the school grounds. Dig a trench or build a wooden frame or simply build a compost pile. The size will depend on amount of compost materials you expect to heve.

Spread composting materials over the area, keeping the center a bit lower than the sides to help in keeping the composting materials moist. When practical, chop or cut the materials into fine pieces. Your custodian might use a mower to do this.

grass clippings or fallen leaves
non-woody plant wastes
vegetable and fruit wastes from lunch boxes and the cafeteria

Avoid animal waste to minimize odor and scavenger problems.

As each layer of abou. 3-4 inches accumulates add a thin layer of soil and sprinkle some garden fertilizer over it.

Occasionally mix the composting material using a spade or garden fork. This helps provide air needed by decay organisms.

The time for decompostion into humus will depend on temperature, moisture, and materials used. Humus can be dug from the bottom and new materials added at the surface. The humus can be used on school grounds, taken home to gardens, or used for potted plants.

RECYCLING ALUMINUM

Many communities have a pickup station for reusable aluminum located within reasonable distance. Many more could if concerned citizens would take some intitiative to establish one. Recycling centers provide monetary gain for those who contribute and for those who operate them.

Aluminum is derived from bauxite which is abundant in the earth's crust. Bauxite is an exhaustible resource. It cannot be renewed as can trees and humus. But aluminum is reusable (recyclable).

The fall, 1979, NSTA Elementary Science Packet includes resource materials on aluminum and recycling aluminum as well as a lesson plan for use with "A Lesson from Nature", a six minute color/sound film on recycling available for free loan from the Aluminum Company of America.

ADDITIONAL ACTIVITIES

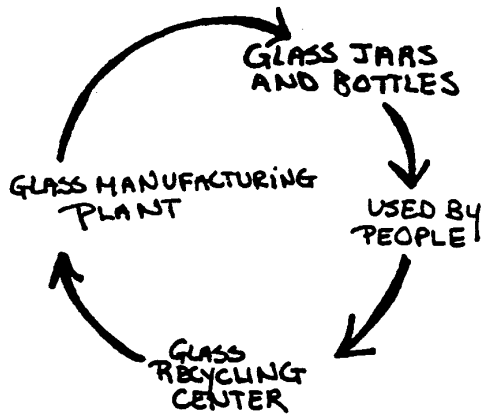
Children can by weighing, find out the approximate number of aluminum cans equivalent to a pound.

They can learn the meaning of renewable and non-renewable resources and classify various resources that are important in their lives according to those catagories.

Discuss the aesthetic and civic aspects of trash discarded along roadsides.

Investigate what happens to different kinds of roadside waste material as time passes, i.e., rusting cans, biological decompostions (paper), no decompostion (plastic).

A GLASS CYCLE



OTHER TYPES OF RECYCLING TO INVESTIGATE

- paper—cardboard cartons
- glass
- iron and steel
- water, including industrial waste and community sewage
- motor oil

Studies of recycling lend themselves naturally to interweaving other curriculum areas. These examples will suggest others to you.

MAPWORK

Where are the materials collected at your recycling center taken for reclamation? In what parts of the world is bauxite mined?

COMMUNITY STUDY

What does your community do with its solid wastes? What problems are associated with solid waste disposal? How many components of the solid waste collected in your commuity are potentially recyclable?

CURRENT EVENTS

What experimental efforts are being made to utilize the recyclable materials in community solid wastes [refer to newspapers, magazines, radio, and television reports]?

HISTORY

What changes have occured in our uses, attitudes, methods of processing and supplies of a given substance?

COMMUNICATION SKILLS

Children can interview appropriate civic personnel to obtain relevant information such as some of the above. Children can speak to other classes to promote a recycling effort. Use of library and other written materials to obtain information. Writing to resource related industries and government agencies for relevant free materials.

CREATIVE WRITING

As children gain an understanding of some of the examples of recycling they might write imaginative stories of the adventure of a tiny particle of a recyclable substance such as water, air, or aluminum.

CESI FILE SHEET # 9

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

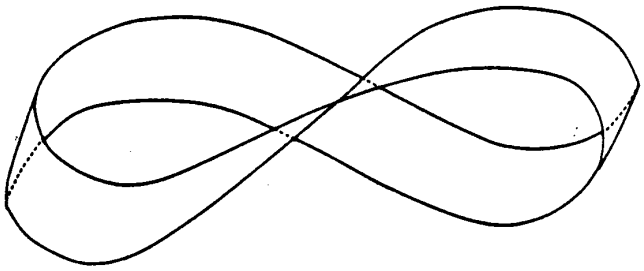
Mobius Strip

1. Use a 50cm strip of adding machine tape. Count the number of surfaces and edges. How many surfaces?_____ How many edges?_____

2. Mark an X on both sides of the same end of the strip. Start at the X and write your name several times along the full length of one side of the tape. Turn the strip upside down. Start at the X and write "Council for Elementary Science International" several times along the full length of the other side of the strip.

3. Curl the strip into a circular ring.

4. Turn one end of the strip 180 degrees (a half twist) and then tape the ends together.



5. This device is called a Mobius Strip. The Mobius was named after its inventor, the German mathematician, August Mobius (1790-1868).

6. Hide the Mobius from view. Make a quick guess at the following:
   How many surfaces on the Mobius?_____
   How many edges on the Mobius?_____

7. Start with the X in front of your name. Use your finger, reading as you go, to trace along the surface of the Mobius strip. How many surfaces on a Mobius strip?_____ How many edges?_____

8. Without lifting the pencil until you return to the starting point, draw a line lengthwise down the middle of the strip.

9. Make the following predictions: What will happen if you cut the Mobius along the pencil line?
   How many pieces from the cut?_____
   How many edges to each cut piece?_____
   How many surfaces to each cut piece?_____

10. What will happen if you cut this new strip lengthwise? Do it and see!

Kids and the Aerodynamics of Paper Airplanes

Children can learn many concepts:

What flight is
Airplanes and how they fly
The science of aerodynamics
Nature's flying machines—birds, bats, insects
History of flight
Navigation and communications
Aviation careers

Children can also learn many process skills:

Observation and classification
Prediction and making operational definitions
Identifying and controlling variables
Collecting and analyzing data
Experimentation
Measuring
Communication

Use these materials:

Assorted types of paper
Paper clips and staples
Scissors
Rulers
Tape, glue, etc.

Try some of these activities:

Make a paper airplane that will fly.
Make an airplane that stays aloft the longest
Make an airplane that flies the farthest distance
Design an airplane that does aerobatic tricks
Investigate the variables that affect the flight of paper airplanes.

Some useful references:

Barnaby, Ralph S. *How to Make and Fly Paper Airplanes.* Four Winds Press, New York City, 1968.

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Energy Sources, Science Curriculum Improvement Study, Rand McNally and Company, Chicago, 1971.

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Stever, H. Guyford, et al. *Flight.* Time-Life Books, New York, 1965.

CESI FILE SHEET # 10

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Hay Infusions

WHAT ARE THEY?

A great, but "smelly" way to grow protozoa and other microscopic organisms in the classroom.

HOW ARE THEY MADE?

They are very easy to make. Use a container between one and five liters in size. A "gallon" pickle jar, a quart jar or a two liter plastic pop bottle with the top cut off will work nicely.

Fill the container almost to the top with water; almost any kind will do. If it is city water and chlorinated, let it stand for 24 hours to allow the chlorine to dissipate.

Add a handful of any kind of hay. If it is rich hay, such as alfalfa or clover, use less; about 5 grams per liter. If you can't get "real hay" just cut some old dead grass from the side of the road and use more of it; 10 or 15 grams per liter.

Cover the container with a loosely-fitting lid. The lid should retard evaporation, but allow carbon dioxide out and oxygen in.

Place the hay infusion on a windowsill or in some other out-of-the-way place. Do not move it around. A scum will form on top of the water after a week or two and it should not be disturbed. The infusion will smell like cow manure at this point if all is going well.

Sample the water from the edge of the jar just under the scum. Use an eyedropper to take a few drops from this area and examine them with a 40-100 power microscope. Protozoans should be present. If you get only a few kinds of small protozoans, innoculate your hay infusion with a few ml (up to one-fourth cup) of muddy pond water. Water from a temporary grassy-bottom pond is best. You may innoculate from several sources to get the best variety of populations.

If you are interested in growing specific types of protozoans purchase them from a biological supply house. You may also purchase a mixed culture for a very reasonable price, $4 or $5. Use these commercial cultures to innoculate two or three different hay infusions to be sure you develop a good one.

Pure cultures may be grown by boiling the hay and water first, letting it cool and then innoculating with a pure culture.

WHY ARE HAY INFUSIONS SO USEFUL?

Hay infusions are great for teaching ecological and population concepts for a number of reasons. Protozoa don't eat much! They are not fussy about their container. You can get a million of them to live in a four liter jar. They reproduce very fast. In some cases they double every eight hours. Dead body disposal is no problem at all. In fact, the dead ones are usually consumed by the live ones.

Contrast this with the use of such animals as elephants or horses, or even mice. Where could you house 10,000 elephants; how could you feed or clean up after them? For that matter, what would you do with the hundreds of dead

ones? Did you ever try to haul away a dead elephant? Before you even start, you have to figure out where to grab the thing. I guess the tail or trunk would provide a good hold, but I don't think you could move it! Well, protozoans are just a lot easier.

WHAT KINDS OF INVESTIGATIONS?

First, hay infusions can be used just to study such protozoa as paramecium, stentor, vorticella and others as well as rotifers.

Hay infusions can also be used to study a number of population and ecological concepts. If the infusions are sampled the same way each day, a rough index of relative numbers can be obtained. Such concepts as ecological succession in populations, predator-prey relationships and growth rate studies can be carried out. A whole host of investigations testing the effects of various environmental factors such as light, temperature, type of water, etc., can be designed using one infusion as a control. In addition, a whole series of investigations involving the effects of various pollutants on the growth of populations can be carried out. Such natural pollutants as clay, salt and acid rain water are good choices. Man-made pollutants such as petroleum products, pesticides and various other chemicals can be used.

To set up a controlled investigation, make two hay infusions exactly alike in all respects. Then, change only one thing in one hay infusion. For example, if you want to determine the effects of a pollutant, such as salt, on the growth of a population of organisms in a hay infusion, add a percentage of salt to one hay infusion but not the other. A good beginning point for the percentage of salt might be 3.5%, which is about the percentage of salt in the oceans.

Sample both hay infusions for a week or two before and after the salt is added. Compare your results. Any differences that occur should be due to the addition of the salt if all other aspects of the hay infusion are kept the same.

Following are two sources of cultures of protozoans:

Carolina Biological Supply Co.
Burlington, N.C. 27215

Turtox Cambosco
MacMillan Science Co.
8200 South Hoyne Ave.
Chicago, Ill. 60620

Try developing some of these protozoan cultures yourself. They are so easy and so interesting I know you will enjoy them. After trying them, write an article for CESI NEWS telling about how you used the hay infusion in your class. Others will be interested!

CESI FILE SHEET #11

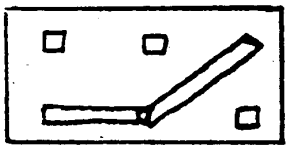
COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

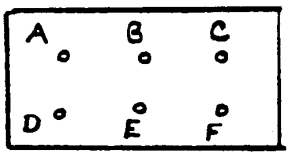
Inference Boards

One's ability to observe phenomena directly is limited. He/she must use observed data to infer the relationships between objects which are interacting in a system. (We have never "seen" the inside of an atom, yet models are constructed which attempt to explain observed phenomena.) Consider the inference board as a system made up of objects (terminals) which can interact through wires or foil strips which connect them. Your task is to make observations and infer how the terminals are connected. Evidence of an interaction would be the lighting of the bulb on the "tester".

Directions:

1. Put together a "testing" device using a battery, holder, bulb, socket and wire. Build a complete circuit, test it to see if the bulb will light.
2. Build the inference board. Materials needed: file cards or pieces of cardboard, foil, masking tape. Punch a pattern of holes in the card for terminals. Patterns may range from 4 holes (simple) to many (complex). Place a small piece of foil over each hole. Decide on the pattern and place foil strips between certain terminals to make electrical connections. Tape foil in place. CAUTION: Do not tape bits of foil over holes and then tape foil strips in place. Remember tape is not an electrical conductor. Draw a model of the inference board BEFORE you cover it. Cover the wiring (foil) with a plain card and tape edges. Label terminals on the front of the card.





3. Exchange inference boards with a neighbor and test the design. Compare your drawings of the model with the original.
4. Make a data table like the one below for recording observations.

Combination TESTED	AB	AC	AD	AE	AF	BC	BD	BE	BF	CD	CE	CF	DE	DF	EF
Responses of bulb (+ lights - does not															

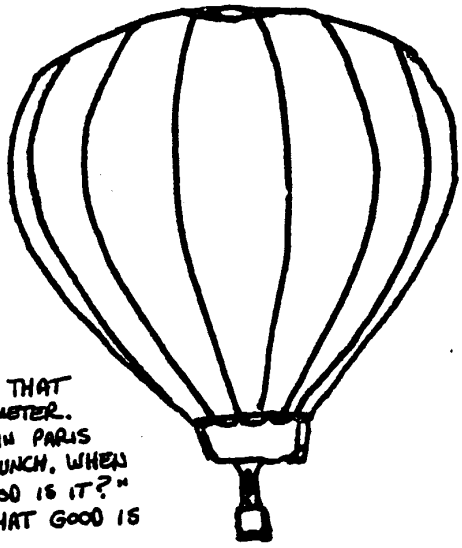
5. Remember that there will be more than one correct drawing of the board based on the collected data.

Questions for students:

1. What conditions are necessary for lighting the bulb when the "tester" wires are touching any two terminals?
2. What is the most efficient method of determining how any one terminal is connected to another?
3. What is the difference between an inference and an observation?
4. Why is it important not to open the inference board?
5. Why might it be important to open the inference board?
6. From testing, do you "know for sure" the exact pattern of the wiring of the terminals on the inference board?

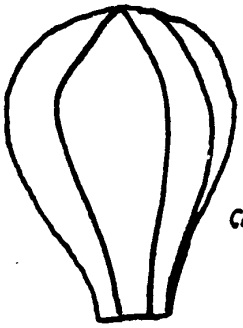
HOT-AIR BALLOONS

BALLOONING IS THE OLDEST FORM OF MAN-MADE FLIGHT. IN THE 1780's, TWO FRENCH BROTHERS, JACQUES ETIENNE AND JOSEPH MONTGOLFIER, BEGAN EXPERIMENTING WITH HOT-AIR BALLOONS. THEY STARTED FILLING SMALL PAPER BAGS WITH SMOKE AND WATCHED THEM RISE.



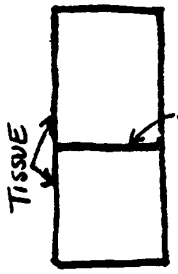
THE PRINCIPLE OF BALLOON FLIGHT IS SIMPLE. PROPANE IS IGNITED IN A BURNER THAT IS PLACED DIRECTLY BENEATH THE OPENING IN THE BOTTOM OF THE BALLOON. THE BALLOON RISES BECAUSE THE AIR INSIDE THE BAG IS WARMER, AND LIGHTER, THAN THE OUTSIDE AIR.

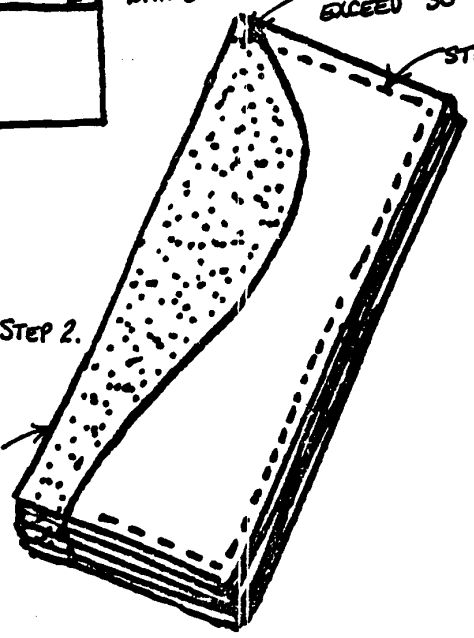
IN 1783, THE BROTHERS LAUNCHED A CLOTH BALLOON THAT MEASURED 35 FEET IN DIAMETER. BENJAMIN FRANKLIN WAS IN PARIS AT THE TIME OF THE LAUNCH. WHEN PEOPLE ASKED, "WHAT GOOD IS IT?" FRANKLIN RETORTED, "WHAT GOOD IS A NEWBORN BABY?"



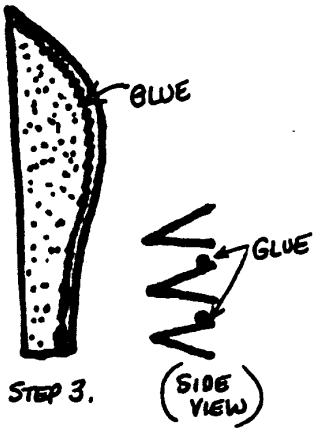
COMPLETED BALLOON

STEP 1.

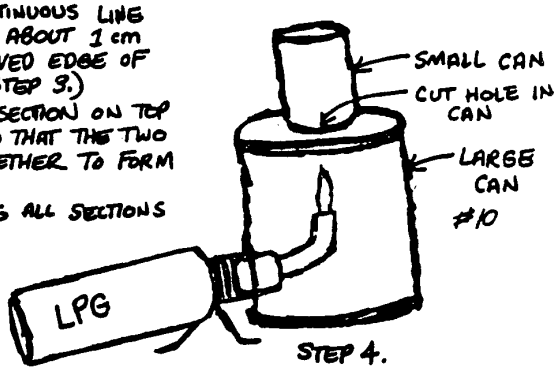




1. YOU NEED 12 SHEETS OF TISSUE PAPER. JOIN 2 TOGETHER END TO END. MAKE 6 PANELS. (STEP 1)
2. FOLD THE PANELS LENGTHWISE AND STACK THEM ON TOP OF EACH OTHER. STAPLE AROUND OPEN EDGES. (STEP 2.)
3. DRAW A PATTERN AS SHOWN IN STEP 2. AND CUT IT OUT.



4. RUN A THIN CONTINUOUS LINE OF WHITE GLUE ABOUT 1 cm IN FROM THE CURVED EDGE OF ONE SECTION. (STEP 3.)
5. PLACE ANOTHER SECTION ON TOP OF THE FIRST SO THAT THE TWO ARE GLUED TOGETHER TO FORM FOLDS.
6. CONTINUE GLUING ALL SECTIONS TOGETHER.
7. COMPLETE THE BALLOON SHAPE BY GLUING THE TWO ENDS TOGETHER.



8. ALLOW THE GLUE TO DRY.
9. INFLATE THE BALLOON WITH A HAIR DRYER. (NOT TO FLY IT.)
10. CONSTRUCT A HEAT SOURCE AS SHOWN IN STEP 4.
11. LAUNCH BALLOON BY HOLDING OVER SMALL CAN UNTIL YOU FEEL A SLIGHT TUGGING. DO NOT TOUCH PAPER TO THE CANS! SOMEONE ELSE SHOULD HOLD THE TOP OF THE BALLOON UPRIGHT UNTIL IT IS FULLY INFLATED.
12. FLY YOUR BALLOON OUTSIDE ON A COLD, STILL DAY.
13. BE CAREFUL WHEN USING OPEN FLAME!

CESI FILE SHEET # 12

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Rocks and Magnets

1. Read Everybody Needs A Rock. Byrd Baylor. Illustrated by Peter Parnall.
2. (Find rocks or give a rock to each participant.)
3. "Get to know your rock."
4. (Ring-around-the rock...find your rock.)
5. (Rocks)
   a. Describe your rock. How do you know it is a rock?
   b. How are the rocks alike? Different?
   c. Who has a rock like _____'s rock? How are they alike? Different? How may are alike? Different?
   d. Where do you think these rocks came from? What is your reason for thinking that? (I picked them up on the beach at Ocean City, Maryland. How do you think they got there? Where were they before I picked them up on the beach?)
6. Dip your rock in a tumbler of water. What do you observe after you put the rock in water?
7. (Play a game...) Let's put several rocks on the table (or floor). Look at the rocks and their neighbors ...close your eyes...(change the position or pattern of the rocks or take one of the rocks away) Open your eyes...What do you observe? Were any rocks moved? Taken away? Describe the rock that was taken away...If a rock was moved, which one? Where was it before it was moved? Take turns playing the game.
8. Use your rocks to play "tic-tac-toe" or checkers...
9. (Show the class a piece of magnet tape) What is this? or What do you think this might be? How could we find out? What will it do? What do you think it is used for? How does this magnet differ from other magnets?
10. (Distribute magnet tape to each participant)...Peel the paper from the magnet tape...stick the magnet to your rock...Now, you have a magnet-rock that is not a lodestone? (What is a lodestone?)
11. Do you think each magnet-rock system is as strong as the other? How could you find out? (Number paper clips or staples the magnet will attract and hold...number of sheets of paper the system will hold against a steel door...) How does whatever you tried show that one magnet or magnet-system is stronger than another?
12. What other things could you do with your rocks and magnets? What would you like to know about rocks and magnets? What could you do to learn more about them???
13. Find out!!!

A Habitat for Mealworms

Mealworms are interesting little creatures. They exhibit four stages in their life cycle, and children observe them with enthusiasm. A habitat for mealsworms is very easy to maintain!

You will need the following materials:

A container (a lid is not necessary, but it helps to retain moisture in areas with low humidity)
Unprocessed miller's bran
Paper towel
Cellulose sponge (must be brand-new)
Slices of apple and potato
Mealworm larvae (available at a bait shop or pet store)

Place 2 cm of bran on the bottom of the container. Dampen a paper towel, squeeze it nearly dry, and spread it over the bran. Add another layer of bran. Wet the sponge and place it in the container. Also add a few slices of apple or potato. Now introduce the mealworms to the habitat.

From time to time. check the moisture in the container. Bran should be damp but not soggy. If your container does not have a lid, bran may be sprinkled with water to keep it damp. When bran begins to run low, place another damp paper towel on top and sprinkle another layer of bran in the container. DO NOT DISCARD THE OLD MATERIAL - IT CONTAINS THE EGGS.

Larvae will eat the sponge, so put in a new piece from time to time. Add slices of apple or potato as needed. Larvae will also eat bread, crackers, and other cereal products, but beware of too much salt or sugar.

This is the life cycle of a mealworm: larvae change to pupae; pupae become adult beetles; beetles mate, lay eggs, and die. Eggs hatch into larvae, and the cycle repeats. (Larvae will consume dead beetles.) The length of the life cyle depends on temperature — the warmer the habitat, the faster the change. If larvae are kept in a refrigerator, they will remain in the larva stage for several weeks.

References you may find useful:

Behavior of Mealworms, Elementary Science Study, McGraw-Hill

Environments, Science Curriculum Improvement Study, Rand McNally

Life Cycles, Science Curriculm Improvement Study, Rand McNally

CESI FILE SHEET # 13

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

SOAP BUBBLES - ACTIVITIES FOR SCIENCE INQUIRY AND SCIENCE FUN

"I hope that none of you are yet tired of playing with bubbles, because, as I hope we shall see, there is more in a common bubble than those who have only played with them generally imagine."

--C.V. Boys

First, you will need some materials:

Commercial bubble solution
Bubble pipes and wands
Drinking straws
Dishwashing liquids
Funnels
Tin cans
Lightweight string or thread
Electrical wire, piano wire
Water

Bubble Solutions

Can you make your own bubble solution? Start with one capful of liquid soap (or detergent) in a container, and then try it. Will more soap make better/stronger bubbles?

Can you make a bubble solution for long-lasting bubbles? ...for large bubbles?

What water temperature makes the best bubble solution?

What brand of soap or detergent works best? Are mixtures better? What quantities of different soaps/detergents?

What happens if you put sugar, or dry Jell-o, or Karo syrup into your bubble solution?

What difference does distilled water, or rain water, or other liquid make in your bubble solution?

Bubble Devices

Try using tin cans (remove the ends and tape the cans together) as a bubble blower.

Use drinking straws (blow gently). Try modifying the ends of the straws for different effects.

Bend and shape electrical wire into loops, spirals, etc. Dip into your solution and blow.

Use funnels of varying sizes.

Purchase "Blizzle Pipes" and a variety of wands.

For several children at one time, use shallow trays for bubble solutions.

Blowing Bubbles

Hands and other surfaces must be WET to catch bubbles.

Can you make very small bubbles? ...very large bubbles?

Can you make small bubbles inside big bubbles?

Can you make composite bubbles (several bubbles stuck together)?

Can you catch a bubble in your hand? ...on your head?

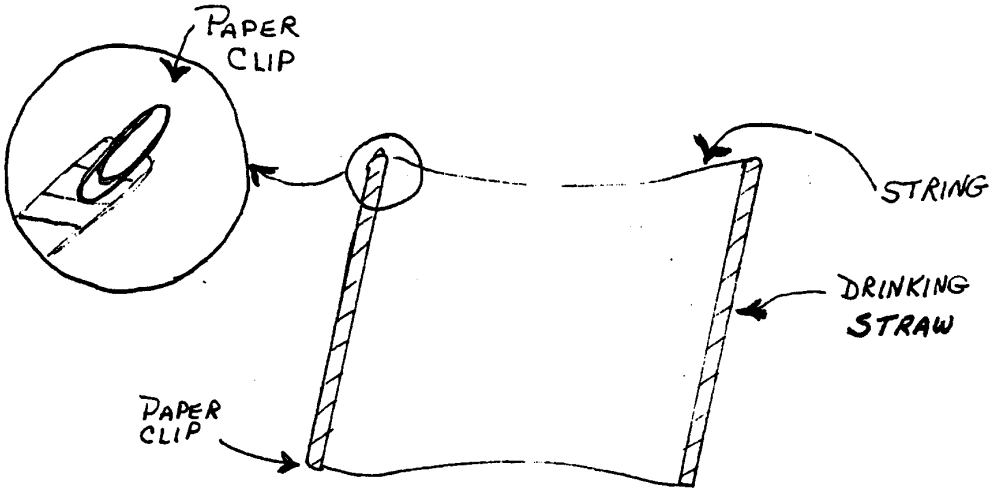
Why do bubbles fall to the ground? How long can you keep a bubble suspended in the air?

Can you make a square bubble?

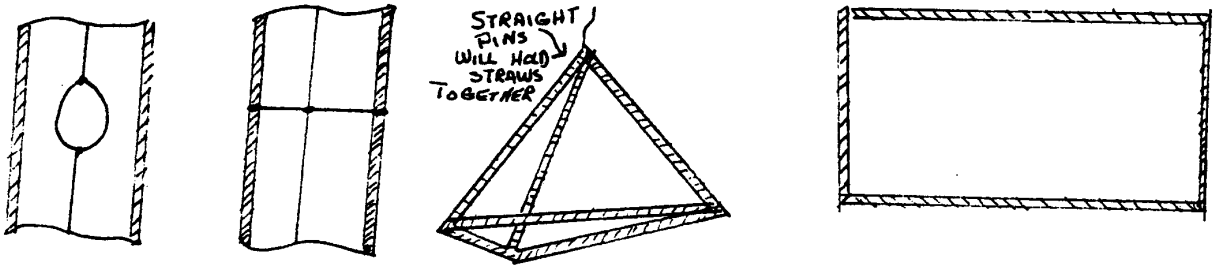
Soap Films

Using shallow trays of bubble solution, you can dip frames to form soap films. Films can be twisted and blown or whisked through the air to release bubbles.

Try constructing a simple frame with two drinking straws and two pieces of string tied between them. (Tying the string will be easier if you place paper clips inside the ends of the straws and attach the string to the paper clips.)



Make variations of the same device by adding more string.
Try making geometric shapes by connecting straws with paper clips.
Electrical wire can also be used to construct frames for soap films.



Some sources of information:

Boys, Charles Vernon. Soap Bubbles. New York: Dover, 1959 (Experiments and the physics behind them.)

DeVito, Alfred and Krockover, Gerald H. Creative Sciencing: Ideas and Activities For Teachers and Children. Second Edition. Boston: Little, Brown & Co., 1980. (Inquiry.)

Zubrowski, Bernie. Bubbles. Boston: Little, Brown and Co., 1979. (Gigantic bubbles and soap films in this book.)

CESI FILE SHEET # 14

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Workshop Potpourri

These activities were presented at C.E.S.I.'s "Meet, Greet, Make, and Take" Workshop at the N.S.T.A. Convention, Anaheim, California, March 1980 by C.E.S.I. Board Members.

THE POWER OF AIR

Air Power Rinse out an empty metal can (such as the kind ditto fluid comes in). Put water to a depth of 1 cm in the can. Heat the can with the cap off until vapor is visible at the opening. CAREFULLY replace the cap, and let the can cool. Observe what happens!

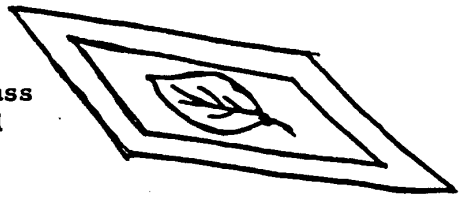
A Heavy Newspaper Place a thin strip of wood (such as a lath or a meter stick) on a table with one end extending about 30 cm over the edge. Lay a piece of newspaper on top of the stick. Strike the end of the stick with a hard, quick blow. Observe what happens to the stick...to the paper...to your hand!

Ping Pong Ball and Funnel Place a ping pong ball in a small funnel. Try blowing the ball out of the funnel! As you blow into the narrow end of the funnel, tilt it slightly. What happens to the ball? Now stop blowing. What happens? Try again!

Make a Submarine Obtain a clear plastic bottle with a cap (an empty detergent bottle will work), and a medicine dropper or small test tube. Fill the bottle with water. Float the medicine dropper or inverted test tube vertically in the water so that when the bottle is capped, the dropper (or test tube) will sink when you squeeze the sides of the bottle! Good luck!!

The Strength of a Soda Straw Can you drive a paper soda straw through a raw potato using only your hands?? Try it and see!

BLUEPRINTING



You will need:
- blueprint paper
- piece of plate glass
- large jar with lid
- cotton balls
- chemical ammonia
- small, flat objects

Arrange several objects (such as leaves, twigs, feathers, etc.) on a piece of blueprint paper. Hold them in place with a piece of plate glass. Expose to strong sunlight or bright lamplight.

Saturate 2-3 cotton balls with chemical ammonia, and place them in the bottom of the jar. DO NOT INHALE THE FUMES!! Place exposed pieces of blueprint paper into the jar, and screw on the lid. Remove them when images appear.

Investigate the chemical process which takes place. What other uses are made of chemical ammonia? How is blueprint paper manufactured? What effect does candlelight or fluorescent light have on blueprint paper? How does the length of exposure or the length of developing affect the picture? Leave some objects in place longer than others under the glass.

Display your picture in a special way - as a book cover or in a collage, for example.

A WINDOWSILL GARDEN

Materials:
- 1 plastic sandwich bag
- 1 sheet of paper towel
- 5 pinto bean seeds
- Tape (or use a "closable" sandwich bag)

Procedure:
1. Fold paper towel in fourths, and place inside the sandwich bag.
2. Add 25 mL of water.
3. Lay the bag flat, and place the seeds on the paper towel.
4. Tape the bag closed and keep it flat.
5. Observe daily.

After the seeds germinate and push up against the bag, cut small holes to let the stems out. Place the bag in a shallow dish, and keep the water level 1-2 cm deep.

The beans should grow to maturity, flower, and produce bean pods!

Try some of these investigations! Compare the growth of beans with and without soil, with and without fertilizer, with different types of paper towel, etc. What other kinds of seeds will germinate and grow in a windowsill garden? How many generations of beans can you produce from your first efforts? Use your imagination to think of other investigations with seeds!

CESI FILE SHEET # 15

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

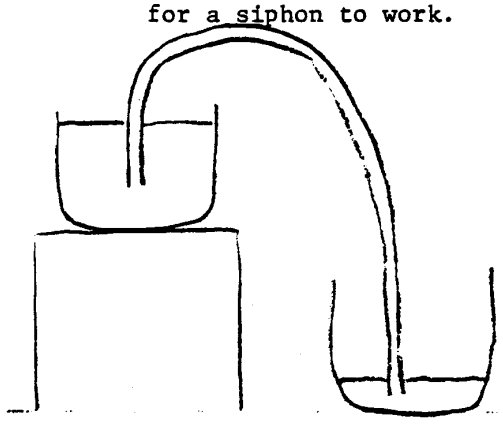
Success with Siphoning

The natural movement and actions of liquids have always captured the attention of youngsters. They will play for hours in puddles, small streams and on beaches. Siphoning brings water movement into the classroom. Students enjoy and are intrigued by siphons at work. The magic of its operation can lead to many interesting investigations into the variables that control siphons.

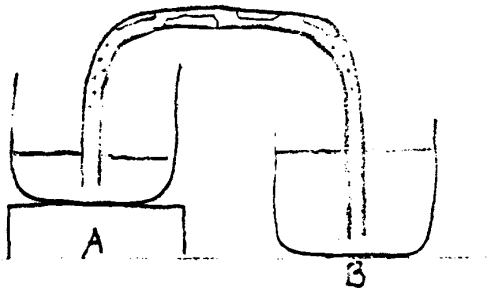
Siphoning involves the force of gravity moving water from one level through a tube to a lower level. To siphon you need only two containers, a piece of tubing and some water. Begin by placing a container 3/4 full of water on an elevated surface. Place the other, empty container nearby. Now completely fill the tube with water by dunking the tube underwater in a sink. Another way is to place one end of the tube under a running faucet and hold the other end at the same level, but not in the stream of water. In either case, cap both ends of the tube with your fingers after the tube is filled with water. The tube must be completely full of water with almost no air bubbles.

Now that the tube is full of water, keep both ends capped and place one end of the tube in the empty container and the other end in the container with the water. When the end of the tube is under the water, release both ends of the tube simultaneously. Water should begin to flow through the tube from the container with the water at the higher level to the empty container at the lower level. If water does not begin to flow, make sure that the water level in the container with the water is on a higher level than the tube outlet in the empty container. Also, when the siphon starts, do not let the tube come out of the water at the upper level or the siphon will stop.

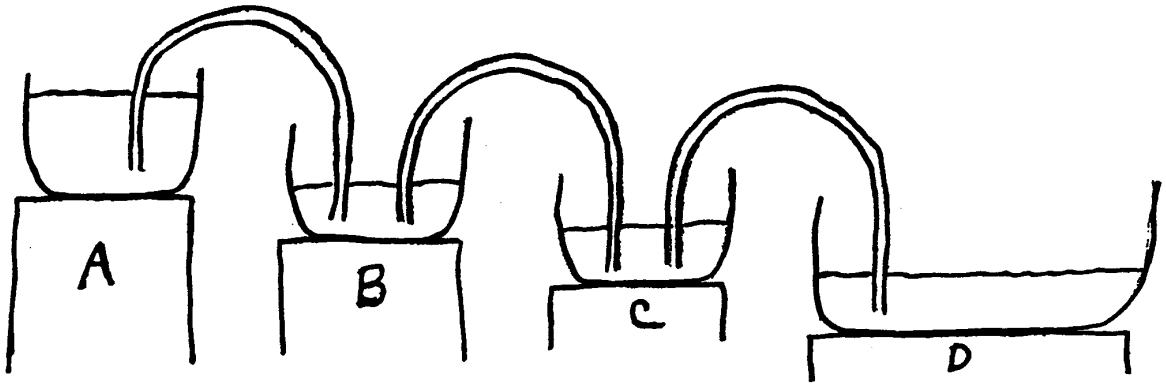
RIGHT - This is the proper setup for a siphon to work.



WRONG - Even though the tube outlet in B is lower than the inlet in A, the water levels are the same, not allowing the siphon to work. Air bubbles in the line will also stop the siphon.



A BASIC SIPHONING SETUP



Place 3 beakers at different levels on a table, stairway, or from the table to a chair to the floor. The beakers should be close enough together so that they can be easily reached by your tubing. Fill all of the containers 3/4 full with water. Run a tube from the beaker at the highest level to the second highest. Run another tube from the beaker at the second highest level to the third. The third tube will go from the third highest beaker to a sink or a large enough container to hold all the water. Siphoning action can be started by filling the tube with water in a sink and capping both ends with your fingers. Place one end in the water in the higher container. Put the other end in the lower container and release your fingers.

After all three siphons have been started, the water level will drop in A, stay about the same in B and C, and rise in D. This is assuming that all conditions are the same. There was the same amount of drop between the levels of water in the containers, and the same amount of water was in all the containers when you started. These are some of the variables that are suggested for later investigations.

Once this sytem is set up the only thing needed for our favorite investigation is a drop or two of food coloring. As soon as the entire siphoning system is started, color the water at the highest level and tell the students a factory has just polluted a nearby stream. Will it show up in the next lake downstream (beaker B)? Or a Great Lake (beaker C)? Or even in the ocean (beaker D)? What will the pollutant look like at each of these levels? These questions help students develop their prediction skills and the answers are easily observed. Is "the solution to pollution dilution" as was once believed?

On page four is a chart suggesting other investigations students can do with this siphoning system.

A SAMPLE INVESTIGATION

The following is a question that we investigated and an example of how the investigation can be set up.

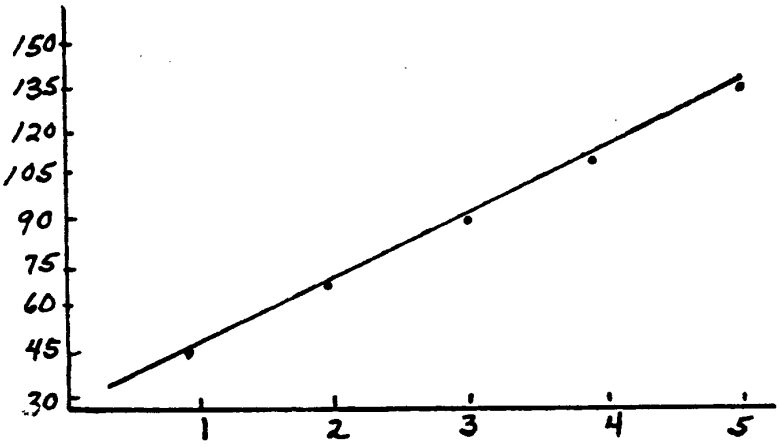
QUESTION: Does the length of the tube affect the rate of flow of the water?

HYPOTHESIS: If the length of the tube increases, then the rate of flow decreases proportionately.

To test this idea we cut a length of tubing 5 m long and recorded how long it took to siphon 300 ml of water, 149 seconds. We then cut 1 m of tubing off so that we had a piece 4 m long and recorded how long it took to siphon that same 300 ml of water, making sure all the other variables were kept constant.

The process was repeated for a 3 m piece, a 2 m piece and finally a piece of tubing 1 m long. Again, all the variables were kept constant, except for the tube length.

The data collected are shown in the graph and table below:



Length of tube (m)	Time to siphon 300 ml of H_2O
5 m	149 sec.
4 m	122 sec.
3 m	97 sec.
2 m	74 sec.
1 m	47 sec.

After analyzing these data we can conclude that the longer the tube, the slower the flow. As the graph also shows, the flow apparently decreases proportionately, thereby supporting our hypothesis.

A real world application of this is evident when using a long garden hose. The longer the hose, the slower the rate of flow.

QUESTION	LAB INVESTIGATION	ANSWER	REAL WORLD APPLICATIONS
If food coloring is added to beaker A, will it show up in B, C, and D?	Refer to the diagram of a siphon setup, page 1. Add food coloring to beaker A and record your observations.	Yes	Is the "solution to pollution dilution?"
Is the siphon system in the diagram a closed system?	Refer to the diagram of a siphon setup, page 1. Observe if water flows indefinitely or if it stops flowing.	No, this is not a closed system. Water must be added to A and removed from D. If the water from D was poured back into A, then the system would be closed.	Relates to the water cycle.
Does the diameter of the tube affect the rate of flow?	Using 2 beakers and 1 tube, record how fast the beaker is emptied. Repeat with a second tube of a different diameter and compare the results. Make sure the water levels and drop are the same as the first time.	Yes, a larger tube will siphon more water in a given amount of time. Record how long it takes to empty the beaker. This will be the rate of flow according to the following formula: $\text{rate of flow} = \frac{\text{volume of water (ml)}}{\text{time to empty (sec.)}}$	Pipe sizes in a publ water system, storm sewers and the kitch sink drain.
Does the amount of drop between the water levels in the beakers affect the rate of flow?	Using 2 beakers and one size tube, siphon the water from 1 beaker to the other and record the rate of flow. Measure the amount of drop between the water levels in the beakers. Double this distance of drop, repeat the procedure and compare results.	Yes, the more drop, the greater the rate of flow of water in a given tube.	The more drop a rive has in a given distance, the faster the water will flow. Thi could produce rapids and falls.
Does adding another tube increase the rate of flow?	Using 2 beakers and 1 tube, siphon the water from 1 beaker to the other. Record the rate of flow. Add another tube and repeat the procedure using both tubes. Determine the rate of flow and compare results.	Yes, more tubes will increase the rate of flow. If 2 tubes of the same diameter are used, the rate of flow should double.	Storm sewer drainage in cities where strea once took care of the flow can cause flooding.
Can you set up your siphon system using 2 sizes of beakers and have it shut off before the smaller one overflows?	Siphon from a large beaker into a small beaker. The small beaker must be arranged so that when it is full, its water level is the same as the water level in the large beaker.	Yes, the siphon will stop when the water levels are the same.	Relates to equilibriu

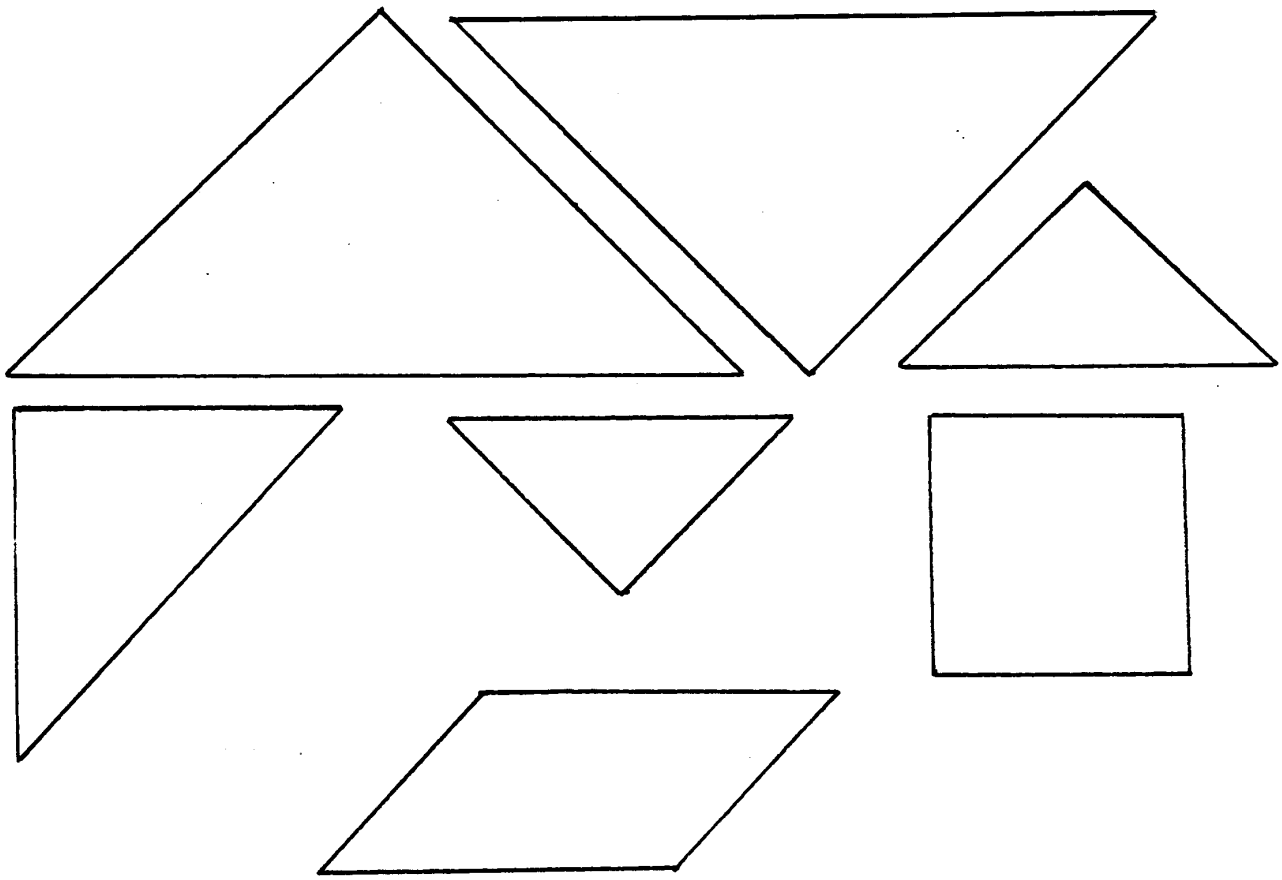
CESI FILE SHEET #16

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

TANGRAMS

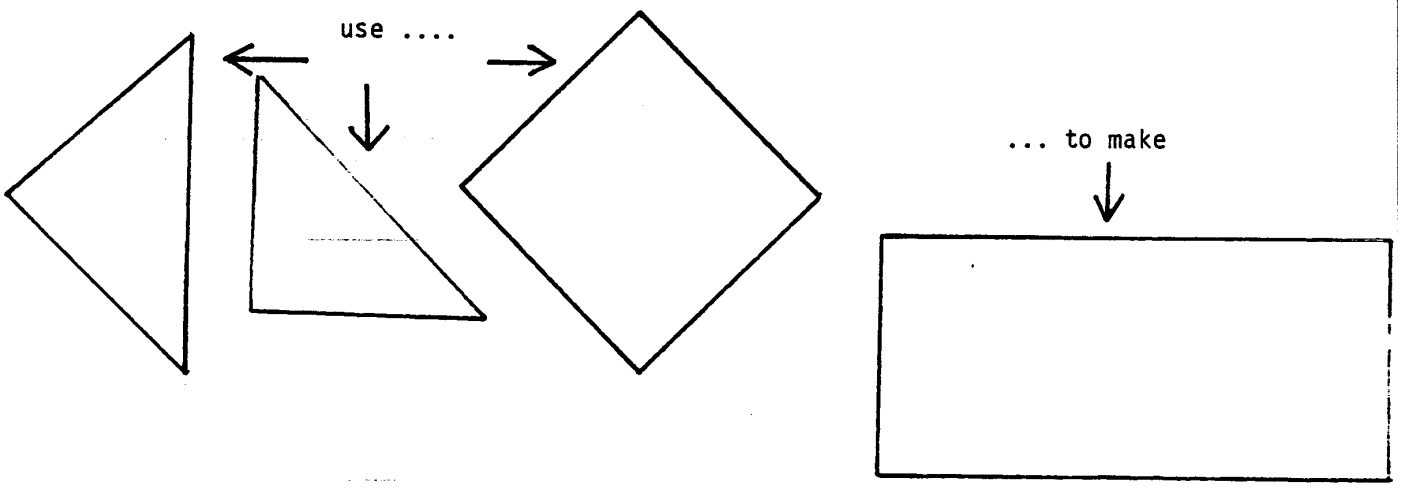
According to legend, in ancient times a Chinese scholar had a favorite ceramic tile that he considered his greatest art treasure. One day he was walking with it in his hands when he tripped. The tile spun from his hands and smashed into seven pieces on the stone floor. The scholar spent the rest of his life trying to put the tile back together again.

Whatever its source in fact, the tangram is an ancient Chinese invention and perhaps the oldest and most enduring of geometric shapes; two large triangles, a medium triangle, two small triangles, a square, and a rhomboid. The Chinese name is ch'i ch'iao t'u, meaning "ingenious seven-piece plan". A great number of geometric and pictorial arrangements can be made with these pieces; a favorite Chinese pastime has been to imitate the characters of written Chinese with the tangram pieces.



This issue of the File Sheet features an activity presented by Dr. Betty Burchett, CESI President, at "Meet, Greet, Make, and Take Workshop", NSTA Convention, Chicago, 1982. Jean Krause, File Sheet Editor.

A good way to introduce tangrams to students of any age is to invite them to use pieces freely, without a pattern to follow. Work with the students on the size relationships of the pieces. Have them make the larger shapes from the smaller ones.



Beginning directly with all seven pieces is difficult for children and for many adults. One adaptation of the tangram begins with smaller groups of the seven piece set, in order to help children develop skill in dealing with basic geometric relationships before they confront more complex problems. In this form, many tangram problems are manageable for preschool children and yet the advanced problems are challenging to most adults. Skill develops through experience and does not automatically increase with age. It is necessary then to have challenging problems available for younger students when they are ready for them. It should not be surprising to find children who are experienced with tangrams undertaking problems which adults find challenging.

Not all children begin by trying to fit the pieces into a printed pattern. Many use the pattern as a map, at least to begin with, and consult it from time to time as they build a matching pattern alongside. Others prefer working on the cards from the beginning. Either way is fine, although some designs may be very difficult to match when tried off a tangram card. Once the children feel that they have become proficient in making the designs, they will want to make designs of their own to challenge classmates or their teacher.

Work with tangrams need not be scheduled as a special activity. The materials can be kept in a specific place in the classroom, and the children can come to them when they have time available before, during, or after school. Depending on their interest, they will want to spend anywhere from a few minutes to hours at a time with the tangrams. Many will probably want to take them home. In any case, the children should proceed at their own pace after you introduce the tangrams and should need little supervision thereafter.

There are many sources of Tangram pieces and puzzle cards. Webster Division - McGraw Hill and Delta Education both have excellent sets of cards.

CESI FILE SHEET # 17

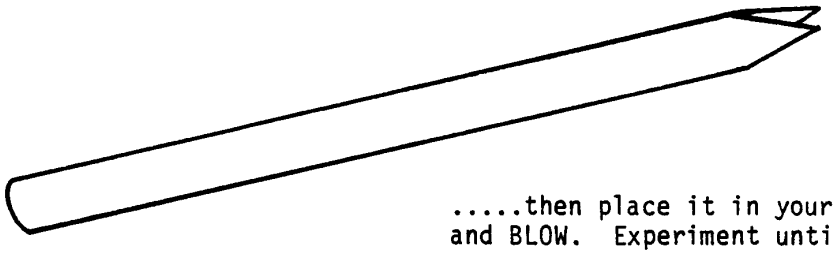
COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE
Jean Krause, Editor

MAKING "MUSIC"

Materials are simple: drinking straws and scissors. You will also need a little lung power.

The objective is to investigate the sound-producing capabilities of drinking straws (in addition to "slurping"!).

Start by cutting one end of the straw like this:



.....then place it in your mouth and BLOW. Experiment until you get the correct placement of the straw between your lips and teeth.

How can you vary the sound you produced <u>without</u> <u>altering</u> the straw?

These activities were presented by C.E.S.I. members, Leon Ukens and Jolene Schulz at the "Meet, Greet, Make and Take" Workshop at the 1982 N.S.T.A. Chicago Convention

Now let's consider some variables.....

How does the length of the straw affect the sound produced?

What happens if you punch holes in the straw?

How does the straw's diameter change the sound?

Does the material the straw is made of have any effect on the sound it produces?

What about the angle of your original cut?

What happens if you cut some slits in the opposite end?

What are some other variables you could investigate??

Here's a challenge for you....

Can you make your straw horn produce a "sliding" sound (like a trombone)??

Try another challenge....

Cut eight straws so that they can produce a musical scale!

Now, find seven friends and play tunes together!

Just think of the possibilities... you can form your own "Straw Horn Band".....invite your parents to a recital....play "Happy Birthday" for your teacher....concerts....you'll be famous!!.....

CESI FILE SHEET #18

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE
Jean P. Krause, Editor

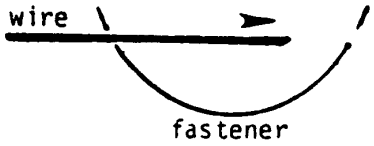
MOBILES

DURABLE MOBILES WITH PARTS THAT ADJUST EASILY

Wire Rods: Use wire cutters to cut off various straight lengths of coat hanger wire. Usually 3 straight pieces can be obtained from most hangers. Use coarse sandpaper or a grinding wheel to round the cut ends of the wire. Cut 3 pieces of wire and round the ends.

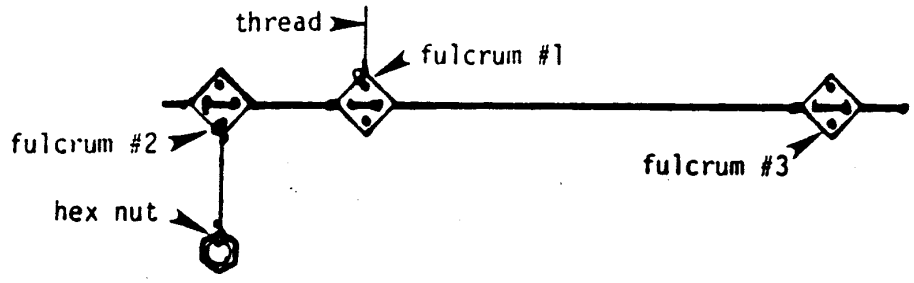
Fasteners: Collect soft plastic soap or milk jugs of various colors. Soak thoroughly to remove residue and labels. Use scissors to cut the plastic into squares that are about one inch or 3 centimeters square. Use a leather punch to punch holes about 1/4 inch (5mm) in from each corner. The second and third smallest punch will fit most sizes of coat hanger wire. Make 3 or 4 fasteners.

Attaching Fasteners to Rods: Slightly bend the plastic squares from corner to corner.



Insert one end of wire into one hole, through the bend and out of the plastic hole as shown above. The flexibility of the plastic holds the fastener firmly in place and still allows you to move it to adjust the balance of your mobile.

This activity was presented by C.E.S.I. Board Member D. Louis Finsand at "Meet, Greet, Make, and Take" Workshop at the 1982 N.S.T.A. Chicago 49. Convention, April 1982.



Make an unequal arm mobile like the one shown above. Then, add a lower level by making something to hang at fulcrum #3. Adjust fulcrum #1, #2, and/or #3 to make the mobile balance evenly.

Make large odd shaped fastener fulcrums from gallon milk jug plastic. Color the shapes with crayon or magic markers. Make a variety of different mobiles.

Make fasteners of other sizes and shapes such as triangles, circles, ovals, and any other shape. Create your own unequal arm mobiles.

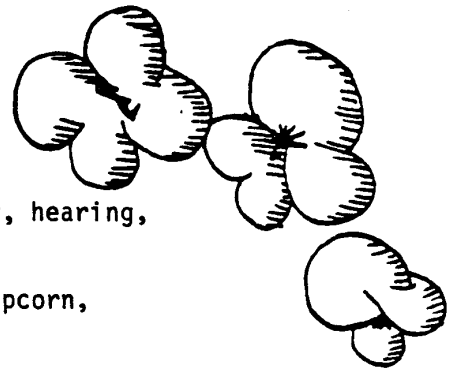
Many excellent mobile teaching ideas and procedures can be obtained from the E.S.S. Mobiles Unit, available from Webster Division, McGraw-Hill Book Company, 1221 Avenue of the Americas, New York, NY 10020.

CESI FILE SHEET # 19

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Jean P. Krause, Editor

FUN WITH POPCORN

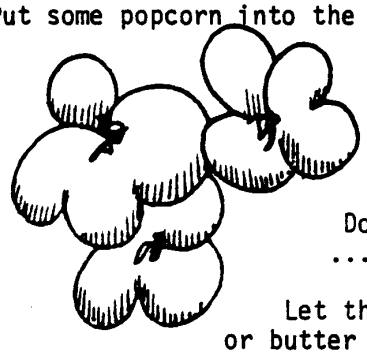


Explore a familiar object - POPCORN - by actively involving the five senses: seeing, hearing, smelling, feeling, tasting.

Materials are simple....popcorn popper, popcorn, seasonings, napkins.

Let the children examine unpopped popcorn kernels. Ask them how they might describe the kernels to someone who had never seen popcorn.

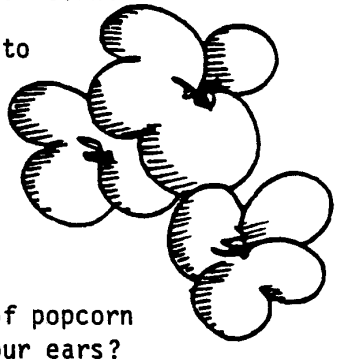
Put some popcorn into the popper (follow the manufacturer's instructions) and LISTEN! How long does it take for the first "pop"? What other sounds do the children hear as the popcorn is popping?



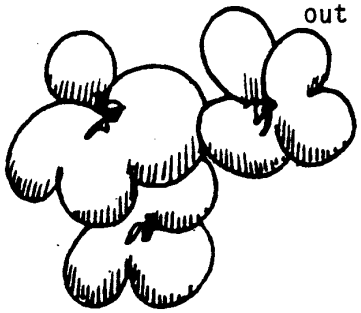
Smell that delicious familiar odor! Do the children also smell the oil (if used)? ... .the salt? ....the butter?

Let them examine popped corn without any seasonings or butter on it. What does it feel like? How has it changed? Who has the largest piece of popcorn? Can the children find the hulls? Look for kernels that did not pop and compare them with fresh unpopped corn.

Now, season the popcorn, and give some to each child to eat. As they eat the kernels, have them describe the taste.

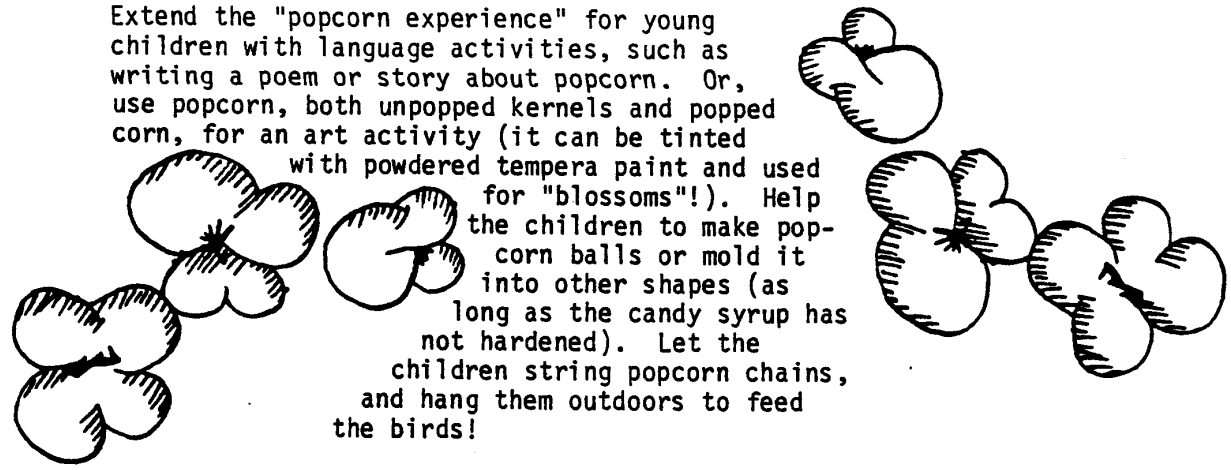


Review how the senses help us to find out about popcorn by asking questions such as these:



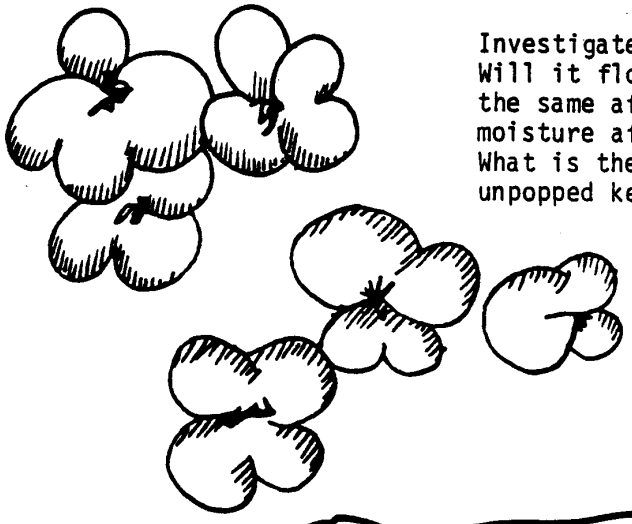
What properties of popcorn did we detect with our ears? ...with our fingers? What could we learn about the popcorn if we could not see it?

Extend the "popcorn experience" for young children with language activities, such as writing a poem or story about popcorn. Or, use popcorn, both unpopped kernels and popped corn, for an art activity (it can be tinted with powdered tempera paint and used for "blossoms"!). Help the children to make popcorn balls or mold it into other shapes (as long as the candy syrup has not hardened). Let the children string popcorn chains, and hang them outdoors to feed the birds!



Here are some popcorn activities for older children:

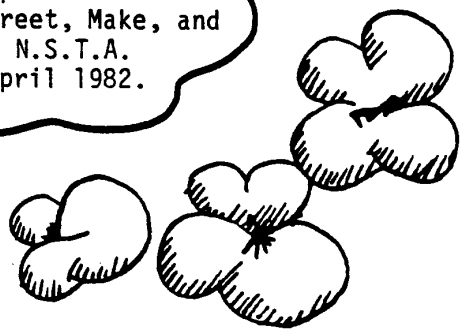
Find out how popcorn is grown and harvested. Examine a popcorn plant if possible, and compare it to field corn or sweet corn.



Investigate some properties of popcorn: Will it float? Does unpopped corn weigh the same after it is popped? How does moisture affect the size of popped kernels? What is the difference in volume between unpopped kernels and popped popcorn?

Soak some popcorn kernels in water overnight. Then place them inside a small plastic bag on a piece of damp paper towel. Observe for several days to see what happens.

This activity was adapted from one presented at "Meet, Greet, Make, and Take" Workshop at the N.S.T.A. Chicago convention, April 1982.



CESI FILE SHEET #20

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Jean P. Krause, Editor

FINGERPRINTS

A person's fingerprints are unique to that individual. Although all fingerprints can be divided into three pattern classes, there is enough diversity within each class so that a set of fingerprints can be used to identify the individual - just by studying ridge characteristics within each pattern class.

ARCH

LOOP

WHORL

Help your students to identify their own fingerprint classes and to examine their own ridge characteristics. Here's how:

Standard Method of Printing

1. Squeeze several small blobs of ink on a glass square. Water-soluble ink is easy to remove.

2. Spread the ink evenly over the entire surface of the glass, using a roller.

3. The fingers should be cleaned with methyl alcohol to remove oil, grease, or dirt.

4. Each finger is prepared for printing by rolling it on the inked glass.

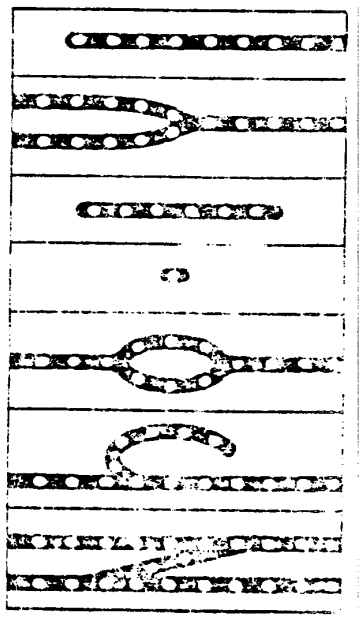
5. The inked finger is then rolled onto a fingerprint card. A plain white index card can be used.

Have students practice their fingerprinting techniques with a partner until they are able to produce a legible set of fingerprints.

Print Interpretation

When students have a legible, complete set of their fingerprints, see what pattern classes they can identify using a lens. Use a table such as the one below to record data.

Once their pattern classes are determined, students can examine the characteristics of ridges within each pattern area - again using a magnifying lens. The diagram illustrates standard ridge characteristics.



FINGER	PATTERN CLASS	RIDGE CHARACTERISTICS
Right thumb		
Right index		
Right middle		
Right ring		
Right little		
Left thumb		
Left index		
Left middle		
Left ring		
Left little		

After students have examined their own fingerprints, encourage them to compare with each other. Find 2-3 students whose right index prints are in the same pattern class, then note the differences in ridge characteristics. How many differences in ridge markings are there? What are they? What is the most frequently found ridge marking in the entire class? What percentage of all fingerprints are arches? ...loops? ...whorls? These and many similar questions can be answered after a careful analysis of your students' fingerprints.

Why not ask your school librarian for help in locating references which describe the characteristics of fingerprints in greater detail? It's a fascinating study!

This activity was presented by Kenneth Mechling at CESI's "Meet, Greet, Make, and Take" Workshop at the NSTA Baltimore Area Convention, November 1982.

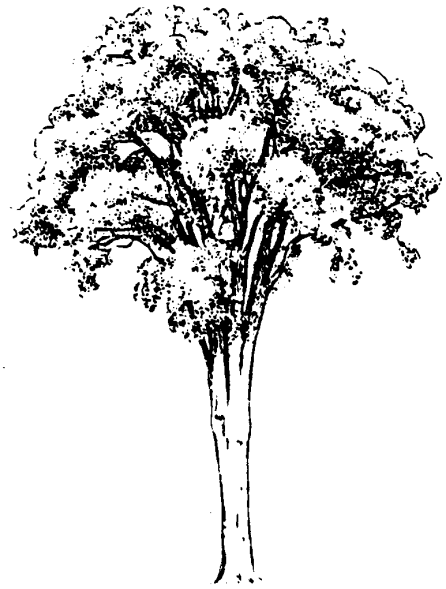
CESI FILE SHEET #21

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Jean P. Krause, Editor

TREES AND MORE TREES

Need some ideas for helping children to better understand the TREES in their environment? Beginning with the first week of school in late summer, take the children to "adopt" a tree (or trees) adjacent to your school.



Get acquainted with "your" tree by identifying it, noting its location, shape, height, girth, etc. For example, is it growing with other trees? ...or standing alone? Was it planted there deliberately? ...or was the seed carried in by the wind or an animal?

Then, periodically observe "your" tree and note the changes:

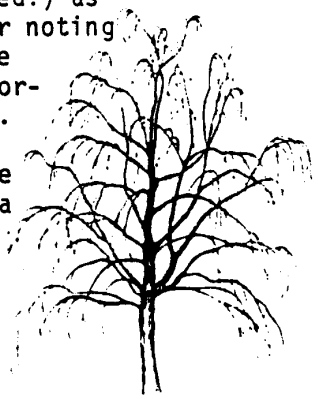
Leaves: color, size, shape

Bark: texture, color

Fruit: seeds, nuts, berries

Animals in residence: insects, mammals, birds

Encourage the children to keep logs (no pun intended!) as they make their observations. Or, write a class log for noting changes the children observe. Write language experience stories about trees, and include original art. Don't forget to write down the date of observations and writings.



Every month or so, take a photograph of "your" tree using color film. Date each photo, then place them on a bulletin board in the order in which they were photographed. Older children can take their own photos. Younger children can too, if you set up the camera on a tripod, focus it, and let them use a cable release to snap the shutter. Try to take the photos from the same spot each time, and get a full-length view if possible.

Close-ups should also be taken, so that comparisons can be made from time to time. Some changes to look for might include:

seed pods as they mature

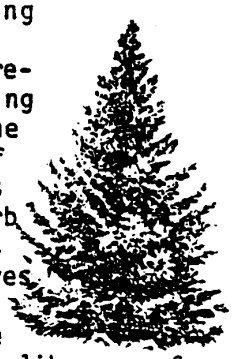
leaves as they change color

evidence of insect activity on the bark

damage from winter storms

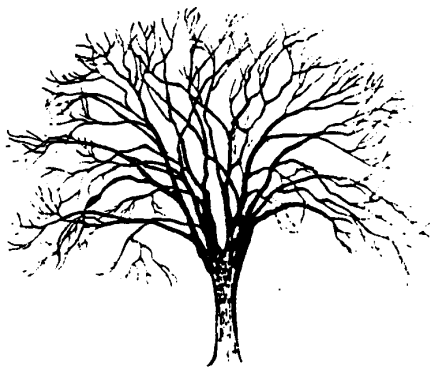
development of buds

emergence of leaves in the spring



All children enjoy collecting leaves, which can be preserved for study in this way: make a leaf press by stacking the leaves between layers of folded newspaper. Be sure the leaves do not touch each other. Then weight down the leaf press with a piece of plywood or similar material and lots of books or other heavy objects. The newspaper will absorb the moisture in the leaves and the weight will keep them flat. Remove the leaves after several days. Now the leaves can be mounted on index cards or tagboard. Cover each leaf with clear plastic contact paper. On the back of the card, write the date and the name of the leaf/tree. Use a library reference to help you identify the leaves.

Older children might enjoy making up a classification key for the leaves they have collected. A library reference will also come in handy for this task.



The mounted leaves can be displayed to illustrate various characteristics. They can be serial ordered according to size, shape, or color. Children could play a matching game with two sets of leaves. One child could describe a leaf and ask another child to identify it.

These few suggestions should help you get started in helping your children to become more familiar with the TREES AND MORE TREES in their environment!

This activity was presented by David L. Williams at CESI's "Meet, Greet, Make, and Take" Workshop at the NSTA Baltimore Area Convention, November 1982.

CESI FILE SHEET #22

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

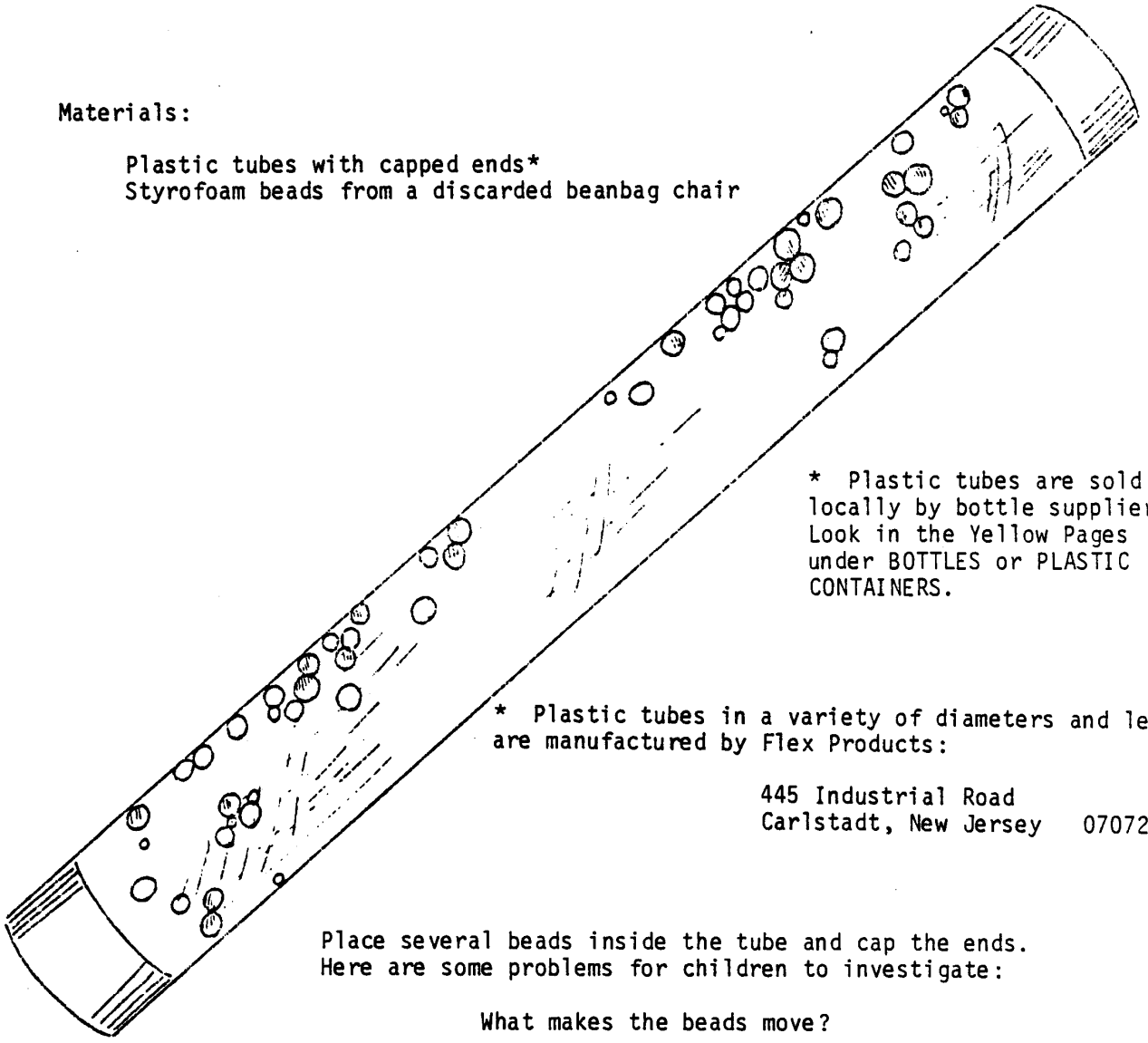
Jean P. Krause, Editor

STATIC TUBES

Children LOVE to experiment with static electricity! Here's a device you can set up and leave - the children can come back to it time and time again.

Materials:

Plastic tubes with capped ends*
Styrofoam beads from a discarded beanbag chair



* Plastic tubes are sold locally by bottle suppliers. Look in the Yellow Pages under BOTTLES or PLASTIC CONTAINERS.

* Plastic tubes in a variety of diameters and lengt are manufactured by Flex Products:

445 Industrial Road
Carlstadt, New Jersey 07072

Place several beads inside the tube and cap the ends. Here are some problems for children to investigate:

What makes the beads move?

Is there a pattern to their movement?

How can you control their movement?

What happens if you rub the tube with (or on) different materials?

What happens to the beads if you leave the tube undisturbed for awhile?

What happens to the beads if you rub one end of the tube?

Can you make the beads move without sticking to the tube or to each other?

How can you get rid of the static charges inside the tube?

What happens when you bring two static tubes next to each other?

Do the beads behave the same way inside other plastic containers?

Do other particles behave the same way as beads inside a plastic tube?

Information and investigations with static electricity can be found in books and periodicals:

Adler, Irving, Electricity In Your Life, Day, 1965.

Asimov, Isaac, How Did We Find Out About Electricity?, Walker, 1973.

Epstein, Sam and Beryl Williams, The First Book of Electricity, Revised Edition, Watts, 1977.

Graf, Rudolf F., Safe and Simple Electrical Experiments, Dover, 1964.

Neal, C. D., Safe and Simple Projects With Electricity, Children's Press, 1965.

Sootin, Harry, Experiments With Static Electricity, W. W. Norton, 1969.

Syrocki, B. John, What Is Electricity?, Benefic Press, 1960.

Science and Children, National Science Teachers Association journal:

Swann, A. Henry, "Static Electricity", October 1968.

McCarthy, Frances W., "Activities in Static Electricity", October 1973.

This activity was presented by Brent R. Jackson at CESI's "Meet, Greet, Make, and Take" Workshop at the NSTA Dallas Convention, April 1983.

CESI FILE SHEET #23

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

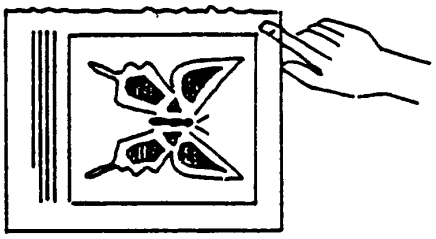
Jean P. Krause, Editor

COLOR-LIFT SLIDES

By following these directions carefully, you can produce 2" x 2" color slides right in your classroom very inexpensively!

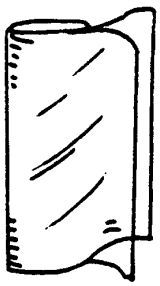
1. You will need these materials:

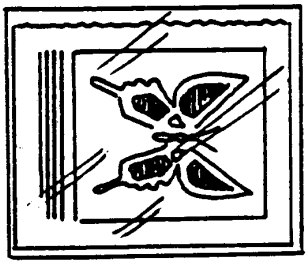
Magazines printed on clay-coated paper *
Scissors
Clear contact paper
Clear acetate film
Liquid detergent
Warm water
Cotton balls
Cardboard slide mounts
Tacking iron



* To test the paper, moisten your finger and rub the margin of a page. If your finger becomes coated with a white, chalky residue, the paper is clay-coated.

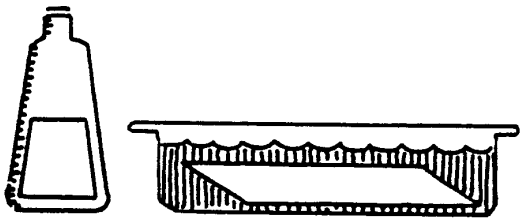
2. Select a small color picture for your slide. Use a slide mount as a pattern - so you will know whether the picture will fit the slide and how much of a margin to leave. Cut out the picture.

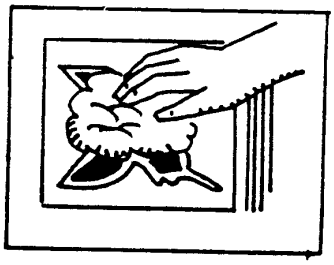




3. Cut a piece of clear contact paper a little larger than the picture, peel away the backing, and place it sticky side down over the picture. (An extra pair of hands would come in handy as you maneuver the contact paper into position!) There should be no wrinkles or bubbles.

4. Rub the picture with a blunt instrument, such as the curved handle of the scissors or the rounded cap on a ballpoint pen. Be VERY careful not to scratch the plastic! Rubbing will ensure good contact of paper to plastic. Rub until all air spaces are removed. The picture will look very shiny.



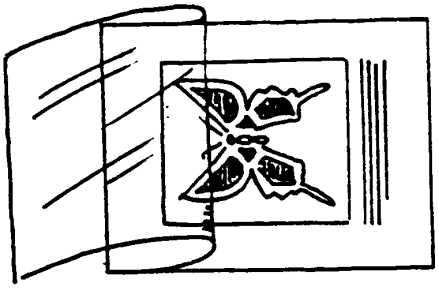


5. Now soak the picture in warm water with a small amount of liquid detergent. After a short time the magazine paper will loosen itself from the plastic and you can peel it away. Notice that the ink from the picture has been transferred to the plastic, along with much of the white clay coating.

6. Rinse the picture thoroughly in clean water. Use a wet cotton ball to remove all of the clay and to protect the inked surface from fingernail scratches. If the clay is not completely removed, the finished slide will look blotchy and discolored.

7. Let the picture dry thoroughly with the sticky side up.

8. Cut a square of clear acetate film the same size as the picture, using your slide mount as a pattern. Press it down onto the picture and rub gently to insure good, smooth contact.



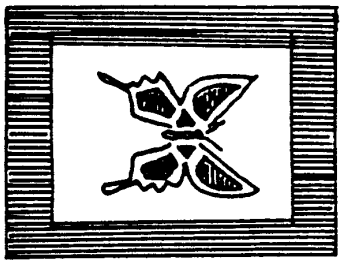
9. Place the picture in the mounting frame. Trim it to fit if necessary.

10. Plug in the tacking iron and allow it to heat up. (You can also use an ordinary steam iron <u>without</u> <u>water</u> in it; set it on "warm" and use just the tip.)

11. Fold the mounting frame over the picture, and heat each of the four sides. Hold the iron just long enough to get a good seal. BE CAREFUL that you do not touch the plastic, only the cardboard.

12. Project your slide and examine its quality. If you aren't satisfied, try again! If you are, make some more slides! Good luck!

This activity was presented by Mel Fuller at CESI's "Meet, Greet, Make, and Take" Workshop at the NSTA Dallas Convention, April 1983.



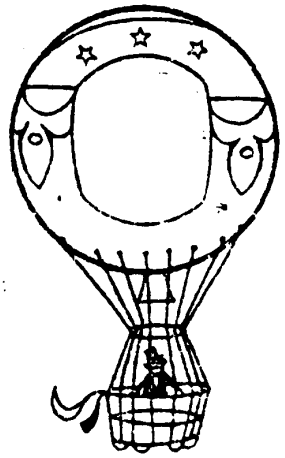
CESI FILE SHEET #24

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Jean P. Krause, Editor

UP, UP, AND AWAY

Have you ever wondered what causes blimps and hot air balloons to behave as they do? You can investigate the vertical forces of gravity and buoyancy that control their behavior by doing the activities that follow.....



Materials needed: *A container of helium*
balloons
Thin string
Modeling clay

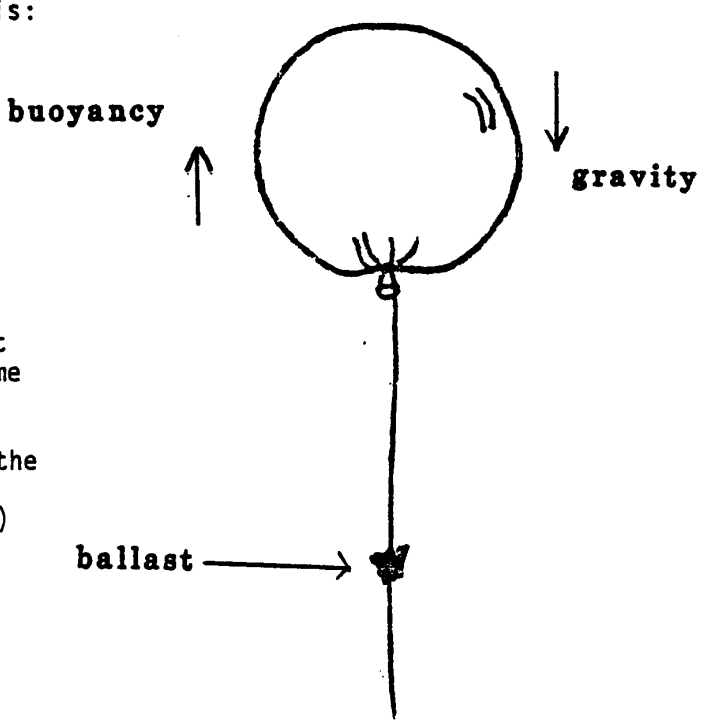
Provide each child in your class with a balloon inflated with helium. Attach a thin string of about 1.5 meters in length to each balloon. Then, if a balloon is accidentally released in the classroom, it can be retrieved. Let the children speculate on what might happen if a balloon containing helium were released outdoors!

Challenge:

"What could you do to make your balloon float halfway between the ceiling and the floor?"

Provide each child with a small lump of modeling clay to attach to the string and act as ballast. Children will adjust the mass of the clay ballast until the balloon floats halfway between the ceiling and the floor.

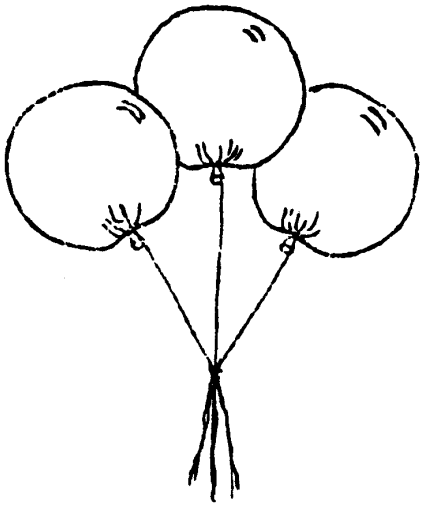
Help the children to identify the vertical forces acting on the balloon with a drawing such as this:



Let the children demonstrate or describe how to make the balloon float closer to the ceiling (by removing some of the ballast). What will happen if more ballast is added? How would the children describe the condition when the balloon floats in place? (The forces of buoyancy and gravity are balanced.)

Invite a hot air balloon pilot to demonstrate his/her balloon and its equipment. Have the pilot point out some other factors that affect the balloon's behavior, such as wind speed and direction, air temperature, the number of people on the flight, etc. Be sure the children notice the ballast the balloon pilot uses. If conditions are right, let the children observe as the hot air balloon is launched....

...and as it flies up....up....and away!!



The first passengers in a hot-air balloon sailed over Paris two hundred years ago.... a DUCK, a ROOSTER, and a SHEEP!

This activity was presented by Robert W. Johnson at CESI's "Meet, Greet, Make, and Take" Workshop at the NSTA Baltimore Area Convention, November 1982.

CESI FILE SHEET #25

COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL—NSTA DIVISION AFFILIATE

Jean P. Krause, Editor

PUMPKIN SCIENCE

Fall is a good time of year to investigate pumpkins! Obtain several pumpkins for your class - one per child would be ideal!

"Introduce" the pumpkins to your children by asking questions like these:

Look at the creases that run side by side (stem to bottom) on the outside of the pumpkin. How many creases does your pumpkin have?

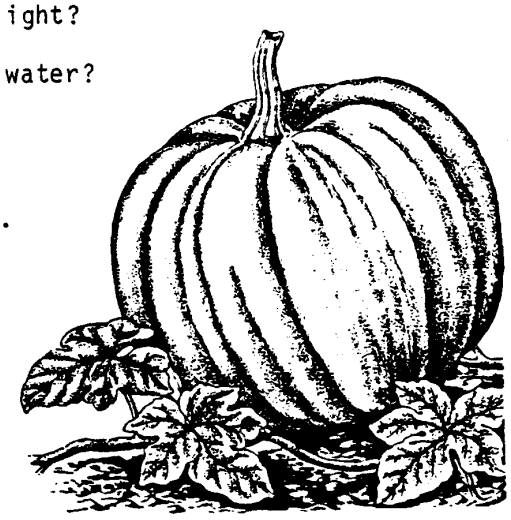
Where on your pumpkin are the creases the deepest? ...the shallowest?

Where on your pumpkin are the creases closest together? ...furthest apart?

By looking at your pumpkin, can you tell which side was on the ground?

From looking only at the stem, can you tell which side of your pumpkin faced the sunlight?

Does your pumpkin float in water?



Did you know??

Pumpkins belong to the family Cucurbitaceae. Cucumbers, gourds, melons, and squashes also belong to this family. The large, orange stock pumpkin is Cucurbita pepo. The finer-textured, straw-colored pumpkin is C. moschata.

A large stock pumpkin may weigh one hundred pounds or more!

Let several children compare their pumpkins by answering questions such as these:

Do all pumpkins have the same number of creases?

Are the creases closer together on bigger pumpkins than on smaller pumpkins?

Do the creases go all the way from the stem to the bottom on big pumpkins as well as on little pumpkins?

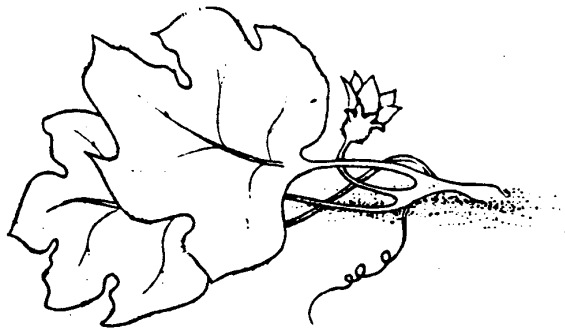
What is your pumpkin's girth (the measurement around the widest part)?

What is the mass of each pumpkin in your group? ...the total mass of all the pumpkins in the class?

What is the price per pound of pumpkins in your local market? How much would it cost for all the pumpkins in the class if you had to pay this price?

Derivations of the word "pumpkin" include pumpion, pompon, and popon from old French, pepō from Latin, and pepōn from Greek.

The pumpkin is a good source of Vitamin A and a fair source of Vitamin C.



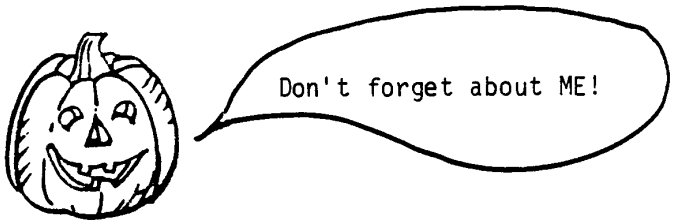
If you aren't tired of pumpkins yet.....

Find out how to cook a pumpkin. Then get a recipe for pumpkin cookies or pumpkin bread (...not to mention pumpkin pie!). (A pumpkin will mold very quickly after it is cut open, so it's best to cook it very soon.)

Roast and eat the pumpkin seeds. They can be seasoned several ways. Some people prefer to eat only the nut part inside the seed, while others eat them whole!

Compare pumpkins - inside and outside - with other fall vegetables such as acorn squash and Hubbard squash.

Need more ideas?? Invite a pumpkin farmer to visit your class. He/she can describe the life cycle, and tell the children how pumpkins are raised for market.



This activity was presented by Joy Underdown at CESI's "Meet, Greet, Make, and Take" Workshop at the NSTA Dallas Convention, April 1983.

Assist each child in cutting open his/her pumpkin. Cut some of the pumpkins from the stem to the bottom and some through the girth. Notice how the inside looks when cut through in different ways. Provide protection for desk tops and tables as the children work. Plastic bags would also be helpful if you intend to save seeds, etc.

Ask some questions about individual pumpkins:

Is your pumpkin mostly full or mostly empty?

Is there something on the inside of your pumpkin that lines up with the creases on the outside?

Are the seeds scattered around inside of your pumpkin, or are they arranged in patterns or groups?

Are all the seeds in your pumpkin the same size?

If we call the stem end of the pumpkin "up", do the pointed ends of the seeds point up, down, sideways, or in all different directions?

If all the seeds inside your pumpkin sprouted and grew, how many pumpkin vines would you have?

How many layers are there in the shell of your pumpkin?

Where is the shell thickest? ...thinnest?

Where is the stringy part attached on the inside of the pumpkin?

What seems to be the relationship of the stringy part to the seeds?

Now examine several pumpkins and find out:

Do bigger pumpkins have more seeds than smaller ones?

Do bigger pumpkins have bigger seeds?

Does the biggest pumpkin have the thickest shell?